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<110> YANASE, Michiyo  
TAKATA, Hiroki  
FUJII, Kazutoshi  
TAKAHA, Takeshi  
Kuriki, Takashi

<120> A METHOD FOR IMPROVING THE THERMOSTABILITY OF ALPH  
A-GLUCAN PHOSPHORYLASE (GP)

<130> EG012PCT

<140> PCT/JP2004/008362

<141> 2004-06-15

<150> JP 2003-173972

<151> 2003-06-18

<160> 48

<170> PatentIn version 3.3

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 gaa gaa aac ttc ttt ctc ttt ggt gct caa gct cat gaa att gca ggg    2599  
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Val Thr Pro Arg Arg Trp Ile Arg Phe Cys Asn Pro Ala Leu Ser Asn  
560 565 570

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Ile Ile Thr Lys Trp Ile Gly Thr Glu Asp Trp Val Leu Asn Thr Glu  
575 580 585 590

aag ttg gca gaa ctg cgc aag ttt gca gat aat gaa gat ctt caa ata 2032



Lys Leu Ala Glu Leu Arg Lys Phe Ala Asp Asn Glu Asp Leu Gln Ile  
595 600 605

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Glu Trp Arg Ala Ala Lys Arg Ser Asn Lys Val Lys Val Ala Ser Phe  
610 615 620

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625 630 635

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755 760 765

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880 885 890

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Thr Ile His Glu Tyr Ala Lys Asp Ile Trp Asn Ile Gln Pro Val Val  
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Gly His Asn Leu Glu Asn Val Ala Ser Lys Glu Pro Asp Ala Ala Leu  
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185 190 195

Val Ser Tyr Pro Val Lys Phe Phe Gly Lys Val Ile Thr Gly Ser Asp  
200 205 210

Gly Lys Lys His Trp Ile Gly Gly Glu Asp Ile Leu Ala Val Ala Tyr  
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Thr Leu Cys Ile Pro Glu Leu Ile Arg Ile Leu Ile Asp Leu Lys Gly  
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Thr Asn His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Tyr Glu  
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Leu Met Glu Lys Leu Leu Pro Arg His Ile Glu Ile Ile Glu Met Ile  
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Arg Phe Cys Asn Pro Ala Leu Ser Asn Ile Ile Thr Lys Trp Ile Gly  
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Phe Ala Asp Asn Glu Asp Leu Gln Ile Glu Trp Arg Ala Ala Lys Arg  
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Ser Asn Lys Val Lys Val Ala Ser Phe Leu Lys Glu Arg Thr Gly Tyr  
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630 635 640 645

Glu Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly Ile Val Tyr Arg Tyr  
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Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln  
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His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val Ile Phe Val Pro Asp  
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Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Gln Ser Asn Met  
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Lys Phe Ala Met Asn Gly Cys Ile Leu Ile Gly Thr Leu Asp Gly Ala  
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-75

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Ala Tyr Tyr Ala Thr Ala Glu Ser Val Arg Asp Thr Leu Ile Ile Asn  
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125 130 135

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140 145 150

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665	670	675	680
ttt atc act gat gta ggg gaa aca gtc aac cat gat ccc gag att ggt    2417			
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685	690	695	
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715	720	725	
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745	750	755	760
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765	770	775	
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845	850	855	
tgg acc aaa atg tcg atc tta aac aca gct gga tcg ttc aaa ttt agc    2945			
Trp Thr Lys Met Ser Ile Leu Asn Thr Ala Gly Ser Phe Lys Phe Ser			
860	865	870	
agt gat cga aca att cat caa tat gca aga gat ata tgg aga att gaa    2993			
Ser Asp Arg Thr Ile His Gln Tyr Ala Arg Asp Ile Trp Arg Ile Glu			

875 880 885

cct gtt gaa tta cct taaaagttag ccagttaaag gatgaaagcc aattttttcc 3048  
Pro Val Glu Leu Pro  
890

ccctgaggtt ctcccatact gtttattagt acatatattg tcaattgttg ctactgaaat 3108

gatagaagtt ttgaatattt actgtcaata aaatacagtt gattccattt gaaaaaaaaa 3168

aaa 3171

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-65 -60 -55 -50

Arg Arg Arg Ile Leu Leu Phe Ser Phe Arg Arg Arg Arg Ser Phe  
-45 -40 -35

Ser Val Ser Ser Val Ala Ser Asp Gln Lys Gln Lys Thr Lys Asp Ser  
-30 -25 -20

Ser Ser Asp Glu Gly Phe Thr Leu Asp Val Phe Gln Pro Asp Ser Thr  
-15 -10 -5

Ser Val Leu Ser Ser Ile Lys Tyr His Ala Glu Phe Thr Pro Ser Phe  
-1 1 5 10 15

Ser Pro Glu Lys Phe Glu Leu Pro Lys Ala Tyr Tyr Ala Thr Ala Glu  
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Ser Val Arg Asp Thr Leu Ile Ile Asn Trp Asn Ala Thr Tyr Glu Phe  
35 40 45

Tyr Glu Lys Met Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe  
50 55 60

Leu Gln Gly Arg Ala Leu Leu Asn Ala Ile Gly Asn Leu Gly Leu Thr  
65 70 75

Gly Pro Tyr Ala Asp Ala Leu Thr Lys Leu Gly Tyr Ser Leu Glu Asp  
80 85 90 95

Val Ala Arg Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly  
100 105 110

Arg Leu Ala Ser Cys Phe Leu Asp Ser Met Ala Thr Leu Asn Tyr Pro  
115 120 125

Ala Trp Gly Tyr Gly Leu Arg Tyr Gln Tyr Gly Leu Phe Lys Gln Leu  
130 135 140

Ile Thr Lys Asp Gly Gln Glu Glu Val Ala Glu Asn Trp Leu Glu Met  
145 150 155

Gly Asn Pro Trp Glu Ile Val Arg Asn Asp Ile Ser Tyr Pro Val Lys  
160 165 170 175

Phe Tyr Gly Lys Val Ile Glu Gly Ala Asp Gly Arg Lys Glu Trp Ala  
180 185 190

Gly Gly Glu Asp Ile Thr Ala Val Ala Tyr Asp Val Pro Ile Pro Gly  
195 200 205

Tyr Lys Thr Lys Thr Thr Ile Asn Leu Arg Leu Trp Thr Thr Lys Leu  
210 215 220

Ala Ala Glu Ala Phe Asp Leu Tyr Ala Phe Asn Asn Gly Asp His Ala  
225 230 235

Lys Ala Tyr Glu Ala Gln Lys Lys Ala Glu Lys Ile Cys Tyr Val Leu  
240 245 250 255

Tyr Pro Gly Asp Glu Ser Leu Glu Gly Lys Thr Leu Arg Leu Lys Gln  
260 265 270

Gln Tyr Thr Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Ala Arg Phe  
275 280 285

Glu Lys Arg Ser Gly Asn Ala Val Asn Trp Asp Gln Phe Pro Glu Lys  
290 295 300

Val Ala Val Gln Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu  
305 310 315

Leu Leu Arg Ile Leu Met Asp Val Lys Gly Leu Ser Trp Lys Gln Ala  
320 325 330 335

Trp Glu Ile Thr Gln Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu  
340 345 350

Pro Glu Ala Leu Glu Lys Trp Ser Phe Thr Leu Leu Gly Glu Leu Leu  
355 360 365

Pro Arg His Val Glu Ile Ile Ala Met Ile Asp Glu Glu Leu Leu His  
370 375 380

Thr Ile Leu Ala Glu Tyr Gly Thr Glu Asp Leu Asp Leu Leu Gln Glu  
385 390 395

Lys Leu Asn Gln Met Arg Ile Leu Asp Asn Val Glu Ile Pro Ser Ser  
400 405 410 415

Val Leu Glu Leu Leu Ile Lys Ala Glu Glu Ser Ala Ala Asp Val Glu  
420 425 430

Lys Ala Ala Asp Glu Glu Gln Glu Glu Glu Gly Lys Asp Asp Ser Lys  
435 440 445

Asp Glu Glu Thr Glu Ala Val Lys Ala Glu Thr Thr Asn Glu Glu Glu  
450 455 460

Glu Thr Glu Val Lys Lys Val Glu Val Glu Asp Ser Gln Ala Lys Ile  
465 470 475

Lys Arg Ile Phe Gly Pro His Pro Asn Lys Pro Gln Val Val His Met  
480 485 490 495

Ala Asn Leu Cys Val Val Ser Gly His Ala Val Asn Gly Val Ala Glu  
500 505 510

Ile His Ser Glu Ile Val Lys Asp Glu Val Phe Asn Glu Phe Tyr Lys  
515 520 525

Leu Trp Pro Glu Lys Phe Gln Asn Lys Thr Asn Gly Val Thr Pro Arg  
530 535 540

Arg Trp Leu Ser Phe Cys Asn Pro Glu Leu Ser Glu Ile Ile Thr Lys  
545 550 555

Trp Thr Gly Ser Asp Asp Trp Leu Val Asn Thr Glu Lys Leu Ala Glu  
560 565 570 575

Leu Arg Lys Phe Ala Asp Asn Glu Glu Leu Gln Ser Glu Trp Arg Lys  
580 585 590

Ala Lys Gly Asn Asn Lys Met Lys Ile Val Ser Leu Ile Lys Glu Lys  
595 600 605

Thr Gly Tyr Val Val Ser Pro Asp Ala Met Phe Asp Val Gln Ile Lys  
610 615 620

Arg Ile His Glu Tyr Lys Arg Gln Leu Leu Asn Ile Phe Gly Ile Val  
625 630 635

Tyr Arg Tyr Lys Lys Met Lys Glu Met Ser Pro Glu Glu Arg Lys Glu  
640 645 650 655

Lys Phe Val Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe Ala Thr  
660 665 670

Tyr Val Gln Ala Lys Arg Ile Val Lys Phe Ile Thr Asp Val Gly Glu  
675 680 685

Thr Val Asn His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val Val Phe  
690 695 700

Val Pro Asp Tyr Asn Val Ser Val Ala Glu Val Leu Ile Pro Gly Ser  
705 710 715

Glu Leu Ser Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr  
720 725 730 735

Ser Asn Met Lys Phe Ser Met Asn Gly Cys Leu Leu Ile Gly Thr Leu  
740 745 750

Asp Gly Ala Asn Val Glu Ile Arg Glu Glu Val Gly Glu Asp Asn Phe  
755 760 765

Phe Leu Phe Gly Ala Gln Ala His Glu Ile Ala Gly Leu Arg Lys Glu  
770 775 780

Arg Ala Glu Gly Lys Phe Val Pro Asp Pro Arg Phe Glu Glu Val Lys  
785 790 795

Ala Phe Ile Arg Thr Gly Val Phe Gly Thr Tyr Asn Tyr Glu Glu Leu  
 800 805 810 815

Met Gly Ser Leu Glu Gly Asn Glu Gly Tyr Gly Arg Ala Asp Tyr Phe  
 820 825 830

Leu Val Gly Lys Asp Phe Pro Asp Tyr Ile Glu Cys Gln Asp Lys Val  
 835 840 845

Asp Glu Ala Tyr Arg Asp Gln Lys Lys Trp Thr Lys Met Ser Ile Leu  
 850 855 860

Asn Thr Ala Gly Ser Phe Lys Phe Ser Ser Asp Arg Thr Ile His Gln  
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Tyr Ala Arg Asp Ile Trp Arg Ile Glu Pro Val Glu Leu Pro  
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 Met Ala Ser Met Thr Met Arg Phe His Pro Asn Ser Thr Ala Val Thr  
 -60 -55 -50

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 Glu Ser Val Pro Arg Arg Gly Ser Val Tyr Gly Phe Ile Gly Tyr Arg  
 -45 -40 -35

tcc tcg tcg ttg ttc gtc cga acg aac gtt atc aag tat cgt tct gtt 201  
 Ser Ser Ser Leu Phe Val Arg Thr Asn Val Ile Lys Tyr Arg Ser Val  
 -30 -25 -20

aag cgt aat ctg gaa ttt agg agg aga agc gct ttc tct gtg aag tgt 249  
 Lys Arg Asn Leu Glu Phe Arg Arg Arg Ser Ala Phe Ser Val Lys Cys  
 -15 -10 -5 -1

ggt tct ggt aat gaa gcg aaa cag aaa gtc aag gat cag gaa gtt caa 297  
 Gly Ser Gly Asn Glu Ala Lys Gln Lys Val Lys Asp Gln Glu Val Gln  
 1 5 10 15

caa gaa gct aaa act tct ccg agc tca ttt gca cca gat act act tcc 345  
 Gln Glu Ala Lys Thr Ser Pro Ser Ser Phe Ala Pro Asp Thr Thr Ser  
           20                  25                  30

att gtg tca agt att aag tac cat gca gag ttc aca cca ctg ttt tct 393  
 Ile Val Ser Ser Ile Lys Tyr His Ala Glu Phe Thr Pro Leu Phe Ser  
           35                  40                  45

ccg gaa aaa ttt gag ctt cca caa gct ttc att gca act gca cag agt 441  
 Pro Glu Lys Phe Glu Leu Pro Gln Ala Phe Ile Ala Thr Ala Gln Ser  
           50                  55                  60

gtt cgt gat gct ctc ata ata aac tgg aat gct act tat gat tac tat 489  
 Val Arg Asp Ala Leu Ile Ile Asn Trp Asn Ala Thr Tyr Asp Tyr Tyr  
           65                  70                  75                  80

gag aag ctg aat gtt aag cag gca tat tac ctt tca atg gaa ttt tta 537  
 Glu Lys Leu Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu  
           85                  90                  95

cag gga aga gca tta ttg aat gca att ggc aat tta gag cta act ggt 585  
 Gln Gly Arg Ala Leu Leu Asn Ala Ile Gly Asn Leu Glu Leu Thr Gly  
           100                  105                  110

ccc tat gca gag gct ttg agc cag ctt agt tat aaa tta gaa gac gtg 633  
 Pro Tyr Ala Glu Ala Leu Ser Gln Leu Ser Tyr Lys Leu Glu Asp Val  
           115                  120                  125

gca cac cag gag ccg gat gct gca ctt gga aat ggg ggt ctt gga cga 681  
 Ala His Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg  
           130                  135                  140

ctt gct tca tgt ttc ttg gac tct ttg gct acc ttg aat tat ccg gca 729  
 Leu Ala Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala  
           145                  150                  155                  160

tgg ggt tat gga ctg aga tac aag tat ggc tta ttc aaa caa cga atc 777  
 Trp Gly Tyr Gly Leu Arg Tyr Lys Tyr Gly Leu Phe Lys Gln Arg Ile  
           165                  170                  175

acc aaa gat ggg caa gag gaa gtt gct gaa gat tgg ctc gag atg ggc 825  
 Thr Lys Asp Gly Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Met Gly  
           180                  185                  190

aat cct tgg gag atc gtt aga aat gac gtc tca tac cct gta agg ttc 873  
 Asn Pro Trp Glu Ile Val Arg Asn Asp Val Ser Tyr Pro Val Arg Phe  
           195                  200                  205

tat ggc aaa gtt gtt tca ggc tca gat ggt aaa aaa cat tgg gtt gga 921  
 Tyr Gly Lys Val Val Ser Gly Ser Asp Gly Lys Lys His Trp Val Gly  
           210                  215                  220

gga gaa gat atc aaa gct gtt gca cac gat gtc ccc ata ccc gga tat 969  
 Gly Glu Asp Ile Lys Ala Val Ala His Asp Val Pro Ile Pro Gly Tyr  
           225                  230                  235                  240

aag acc aga agc aca att aac ctg aga ctt tgg tct aca aaa gct gca 1017  
 Lys Thr Arg Ser Thr Ile Asn Leu Arg Leu Trp Ser Thr Lys Ala Ala  
           245                  250                  255



tcc gaa gaa ttt gat tta aat gct ttt aat tct gga agg cac acc gaa 1065  
Ser Glu Glu Phe Asp Leu Asn Ala Phe Asn Ser Gly Arg His Thr Glu  
260 265 270

gca tct gag gct cta gca aat gct gaa aag att tgc tat ata ctt tac 1113  
Ala Ser Glu Ala Leu Ala Asn Ala Glu Lys Ile Cys Tyr Ile Leu Tyr  
275 280 285

ccc ggg gat gaa tct ata gag gga aaa acc ctt cgc ctc aag caa caa 1161  
Pro Gly Asp Glu Ser Ile Glu Gly Lys Thr Leu Arg Leu Lys Gln Gln  
290 295 300

tat act tta tgt tcg gct tct ctt caa gat atc att gct cgt ttt gag 1209  
Tyr Thr Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Ala Arg Phe Glu  
305 310 315 320

aga aga tca ggg gca agt gtg aat tgg gaa gac ttt cct gaa aag gtt 1257  
Arg Arg Ser Gly Ala Ser Val Asn Trp Glu Asp Phe Pro Glu Lys Val  
325 330 335

gca gtg cag atg aat gat act cac cca act ttg tgc atc cca gag ctg 1305  
Ala Val Gln Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu Leu  
340 345 350

atg aga atc ctg ata gat ata aag ggt tta agc tgg aag gat gct tgg 1353  
Met Arg Ile Leu Ile Asp Ile Lys Gly Leu Ser Trp Lys Asp Ala Trp  
355 360 365

aat atc acc caa cgg act gta gca tac aca aac cat act gtt ctt ccg 1401  
Asn Ile Thr Gln Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro  
370 375 380

gag gca tta gag aaa tgg agc atg gac ctt atg gag aaa ttg ctt cca 1449  
Glu Ala Leu Glu Lys Trp Ser Met Asp Leu Met Glu Lys Leu Leu Pro  
385 390 395 400

cgc cat gtt gag att ata gaa atg att gat gag gag ctg att cgg acc 1497  
Arg His Val Glu Ile Ile Glu Met Ile Asp Glu Glu Leu Ile Arg Thr  
405 410 415

ata atc gca gaa tat ggc aca gca gat tca gac tta ctt gat aag aaa 1545  
Ile Ile Ala Glu Tyr Gly Thr Ala Asp Ser Asp Leu Leu Asp Lys Lys  
420 425 430

ttg aag gaa atg aga ata cta gaa aat gtt gaa ttg cct gca gaa ttt 1593  
Leu Lys Glu Met Arg Ile Leu Glu Asn Val Glu Leu Pro Ala Glu Phe  
435 440 445

gca gat ata cta gtt aaa acc aag gag gcc act gat att tct agt gag 1641  
Ala Asp Ile Leu Val Lys Thr Lys Glu Ala Thr Asp Ile Ser Ser Glu  
450 455 460

gaa gtg caa att tct aaa gaa ggg gga gaa gaa gaa act tct aaa 1689  
Glu Val Gln Ile Ser Lys Glu Gly Gly Glu Glu Glu Thr Ser Lys  
465 470 475 480

gaa ggg gga gaa gaa gaa gaa gaa aaa gaa gta gga gga gga aga gaa 1737  
Glu Gly Gly Glu Glu Glu Glu Lys Glu Val Gly Gly Gly Arg Glu  
485 490 495

gaa ggc gat gat ggt aag gaa gat gaa gtg gaa aaa gca att gct gaa 1785  
Glu Gly Asp Asp Gly Lys Glu Asp Glu Val Glu Lys Ala Ile Ala Glu  
500 505 510

aag gat gga acg gtt aaa agc tcc att ggg gat aag aaa aag aag ttg 1833  
Lys Asp Gly Thr Val Lys Ser Ser Ile Gly Asp Lys Lys Lys Lys Leu  
515 520 525

cct gag cca gta cca gta ccg cca aaa ttg gtt cgt atg gcc aat ctt 1881  
Pro Glu Pro Val Pro Val Pro Pro Lys Leu Val Arg Met Ala Asn Leu  
530 535 540

tgt gtt gtg ggt ggt cat gca gtg aat ggg gtt gca gag ata cat agt 1929  
Cys Val Val Gly Gly His Ala Val Asn Gly Val Ala Glu Ile His Ser  
545 550 555 560

gaa att gtc aag gat gac gtg ttc aat gca ttt tat aag ttg tgg cct 1977  
Glu Ile Val Lys Asp Asp Val Phe Asn Ala Phe Tyr Lys Leu Trp Pro  
565 570 575

gag aaa ttc cag aac aaa aca aat ggc gtg acg cct agg aga tgg att 2025  
Glu Lys Phe Gln Asn Lys Thr Asn Gly Val Thr Pro Arg Arg Trp Ile  
580 585 590

agg ttc tgc aat cca gat ttg agt aaa ata ata act cag tgg ata ggc 2073  
Arg Phe Cys Asn Pro Asp Leu Ser Lys Ile Ile Thr Gln Trp Ile Gly  
595 600 605

aca gaa gac tgg atc cta aat act gag aaa ctg gct gaa ctg cgg aag 2121  
Thr Glu Asp Trp Ile Leu Asn Thr Glu Lys Leu Ala Glu Leu Arg Lys  
610 615 620

ttt gca gat aat gag gat ctg caa aca caa tgg agg gaa gca aaa agg 2169  
Phe Ala Asp Asn Glu Asp Leu Gln Thr Gln Trp Arg Glu Ala Lys Arg  
625 630 635 640

aat aac aag gtg aaa gtt gca gca ttc ctc aga gaa aga aca gga tat 2217  
Asn Asn Lys Val Lys Val Ala Ala Phe Leu Arg Glu Arg Thr Gly Tyr  
645 650 655

tct gtc agt cct gat tca atg ttt gac atc cag gtg aaa aga atc cat 2265  
Ser Val Ser Pro Asp Ser Met Phe Asp Ile Gln Val Lys Arg Ile His  
660 665 670

gaa tat aaa cga caa tta tta aat ata ttt gga att gtt tat cgc tac 2313  
Glu Tyr Lys Arg Gln Leu Leu Asn Ile Phe Gly Ile Val Tyr Arg Tyr  
675 680 685

aag aag atg aaa gaa atg aat gct gct gaa aga aaa gaa aat ttt gtt 2361  
Lys Lys Met Lys Glu Met Asn Ala Ala Glu Arg Lys Glu Asn Phe Val  
690 695 700

cca aga gtt tgt ata ttt ggg gga aaa gca ttt gct act tat gtg caa 2409  
Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln  
705 710 715 720

gcc aaa aga att gtg aaa ttt att aca gat gtt gga gct act gta aat 2457  
Ala Lys Arg Ile Val Lys Phe Ile Thr Asp Val Gly Ala Thr Val Asn  
725 730 735

cat gat cca gaa ata gga gat ctt ctt aag gtt att ttt gtc cct gac 2505  
His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val Ile Phe Val Pro Asp  
740 745 750

tac aat gtt agt gtt gcg gag atg ctt att cct gct agt gaa ttg tca 2553  
Tyr Asn Val Ser Val Ala Glu Met Leu Ile Pro Ala Ser Glu Leu Ser  
755 760 765

caa cat atc agt act gct gga atg gag gca agt gga act agc aac atg 2601  
Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met  
770 775 780

aaa ttt gca atg aat gga tgc tta cag att gga act ttg gat ggg gcc 2649  
Lys Phe Ala Met Asn Gly Cys Leu Gln Ile Gly Thr Leu Asp Gly Ala  
785 790 795 800

aat gtt gaa ata agg gaa gag gtt ggt gct gac aac ttc ttc ctt ttt 2697  
Asn Val Glu Ile Arg Glu Glu Val Gly Ala Asp Asn Phe Phe Leu Phe  
805 810 815

ggt gct aag gct cgt gaa att gtt ggg ctc agg aaa gaa aga gca aga 2745  
Gly Ala Lys Ala Arg Glu Ile Val Gly Leu Arg Lys Glu Arg Ala Arg  
820 825 830

ggg aag ttt gtc cct gat cca cga ttc gaa gaa gtt aaa aaa ttt gtc 2793  
Gly Lys Phe Val Pro Asp Pro Arg Phe Glu Glu Val Lys Lys Phe Val  
835 840 845

aga agt ggt gtc ttt ggg tct tac aac tat gat gaa ctg att gga tcc 2841  
Arg Ser Gly Val Phe Gly Ser Tyr Asn Tyr Asp Glu Leu Ile Gly Ser  
850 855 860

tta gaa gga aat gaa ggt ttt ggt cga gca gat tat ttt ctt gtg ggc 2889  
Leu Glu Gly Asn Glu Gly Phe Gly Arg Ala Asp Tyr Phe Leu Val Gly  
865 870 875 880

cag gac ttc cct agc tat tta gaa tgc cag gag gag gtc gac aaa gct 2937  
Gln Asp Phe Pro Ser Tyr Leu Glu Cys Gln Glu Glu Val Asp Lys Ala  
885 890 895

tat cgc gac caa aaa aaa tgg aca aga atg tca ata ttg aac aca gca 2985  
Tyr Arg Asp Gln Lys Lys Trp Thr Arg Met Ser Ile Leu Asn Thr Ala  
900 905 910

ggc tca tcc aaa ttc agc agt gac cgt acc att cat gaa tat gca cga 3033  
Gly Ser Ser Lys Phe Ser Ser Asp Arg Thr Ile His Glu Tyr Ala Arg  
915 920 925

gaa ata tgg aac att gag cca gtc aaa ttg gag tagaggggta atctatacta 3086  
Glu Ile Trp Asn Ile Glu Pro Val Lys Leu Glu  
930 935

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taccattag tgaaaaataa actaagtttt gtaaaattaa aataagggtc tggttttaca 3206

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<213> Vicia faba

<400> 8

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-45 -40 -35

Ser Ser Ser Leu Phe Val Arg Thr Asn Val Ile Lys Tyr Arg Ser Val  
-30 -25 -20

Lys Arg Asn Leu Glu Phe Arg Arg Arg Ser Ala Phe Ser Val Lys Cys  
-15 -10 -5 -1

Gly Ser Gly Asn Glu Ala Lys Gln Lys Val Lys Asp Gln Glu Val Gln  
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Gln Glu Ala Lys Thr Ser Pro Ser Ser Phe Ala Pro Asp Thr Thr Ser  
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Ile Val Ser Ser Ile Lys Tyr His Ala Glu Phe Thr Pro Leu Phe Ser  
35 40 45

Pro Glu Lys Phe Glu Leu Pro Gln Ala Phe Ile Ala Thr Ala Gln Ser  
50 55 60

Val Arg Asp Ala Leu Ile Ile Asn Trp Asn Ala Thr Tyr Asp Tyr Tyr  
65 70 75 80

Glu Lys Leu Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu  
85 90 95

Gln Gly Arg Ala Leu Leu Asn Ala Ile Gly Asn Leu Glu Leu Thr Gly  
100 105 110

Pro Tyr Ala Glu Ala Leu Ser Gln Leu Ser Tyr Lys Leu Glu Asp Val  
115 120 125

Ala His Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg  
130 135 140

Leu Ala Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala  
145 150 155 160

Trp Gly Tyr Gly Leu Arg Tyr Lys Tyr Gly Leu Phe Lys Gln Arg Ile  
165 170 175

Thr Lys Asp Gly Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Met Gly  
180 185 190

Asn Pro Trp Glu Ile Val Arg Asn Asp Val Ser Tyr Pro Val Arg Phe  
195 200 205

Tyr Gly Lys Val Val Ser Gly Ser Asp Gly Lys Lys His Trp Val Gly  
210 215 220

Gly Glu Asp Ile Lys Ala Val Ala His Asp Val Pro Ile Pro Gly Tyr  
225 230 235 240

Lys Thr Arg Ser Thr Ile Asn Leu Arg Leu Trp Ser Thr Lys Ala Ala  
245 250 255

Ser Glu Glu Phe Asp Leu Asn Ala Phe Asn Ser Gly Arg His Thr Glu  
260 265 270

Ala Ser Glu Ala Leu Ala Asn Ala Glu Lys Ile Cys Tyr Ile Leu Tyr  
275 280 285

Pro Gly Asp Glu Ser Ile Glu Gly Lys Thr Leu Arg Leu Lys Gln Gln  
290 295 300

Tyr Thr Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Ala Arg Phe Glu  
305 310 315 320

Arg Arg Ser Gly Ala Ser Val Asn Trp Glu Asp Phe Pro Glu Lys Val  
325 330 335

Ala Val Gln Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu Leu  
340 345 350

Met Arg Ile Leu Ile Asp Ile Lys Gly Leu Ser Trp Lys Asp Ala Trp  
355 360 365

Asn Ile Thr Gln Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro  
370 375 380

Glu Ala Leu Glu Lys Trp Ser Met Asp Leu Met Glu Lys Leu Leu Pro  
385 390 395 400

Arg His Val Glu Ile Ile Glu Met Ile Asp Glu Glu Leu Ile Arg Thr  
405 410 415

Ile Ile Ala Glu Tyr Gly Thr Ala Asp Ser Asp Leu Leu Asp Lys Lys  
420 425 430

Leu Lys Glu Met Arg Ile Leu Glu Asn Val Glu Leu Pro Ala Glu Phe  
435 440 445

Ala Asp Ile Leu Val Lys Thr Lys Glu Ala Thr Asp Ile Ser Ser Glu  
450 455 460

Glu Val Gln Ile Ser Lys Glu Gly Gly Glu Glu Glu Glu Thr Ser Lys  
465 470 475 480

Glu Gly Gly Glu Glu Glu Glu Glu Lys Glu Val Gly Gly Gly Arg Glu  
485 490 495

Glu Gly Asp Asp Gly Lys Glu Asp Glu Val Glu Lys Ala Ile Ala Glu  
500 505 510

Lys Asp Gly Thr Val Lys Ser Ser Ile Gly Asp Lys Lys Lys Lys Leu  
515 520 525

Pro Glu Pro Val Pro Val Pro Pro Lys Leu Val Arg Met Ala Asn Leu  
530 535 540

Cys Val Val Gly Gly His Ala Val Asn Gly Val Ala Glu Ile His Ser  
545 550 555 560

Glu Ile Val Lys Asp Asp Val Phe Asn Ala Phe Tyr Lys Leu Trp Pro  
565 570 575

Glu Lys Phe Gln Asn Lys Thr Asn Gly Val Thr Pro Arg Arg Trp Ile  
580 585 590

Arg Phe Cys Asn Pro Asp Leu Ser Lys Ile Ile Thr Gln Trp Ile Gly  
595 600 605

Thr Glu Asp Trp Ile Leu Asn Thr Glu Lys Leu Ala Glu Leu Arg Lys  
610 615 620

Phe Ala Asp Asn Glu Asp Leu Gln Thr Gln Trp Arg Glu Ala Lys Arg  
625                      630                      635                      640

Asn Asn Lys Val Lys Val Ala Ala Phe Leu Arg Glu Arg Thr Gly Tyr  
645                      650                      655

Ser Val Ser Pro Asp Ser Met Phe Asp Ile Gln Val Lys Arg Ile His  
660                      665                      670

Glu Tyr Lys Arg Gln Leu Leu Asn Ile Phe Gly Ile Val Tyr Arg Tyr  
675                      680                      685

Lys Lys Met Lys Glu Met Asn Ala Ala Glu Arg Lys Glu Asn Phe Val  
690                      695                      700

Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln  
705                      710                      715                      720

Ala Lys Arg Ile Val Lys Phe Ile Thr Asp Val Gly Ala Thr Val Asn  
725                      730                      735

His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val Ile Phe Val Pro Asp  
740                      745                      750

Tyr Asn Val Ser Val Ala Glu Met Leu Ile Pro Ala Ser Glu Leu Ser  
755                      760                      765

Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met  
770                      775                      780

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660 665 670

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Val Ser Pro Asp Ala Met Phe Asp Ile Gln Ile Lys Arg Ile His Glu  
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Lys Tyr Val Pro Asp Pro Cys Phe Glu Glu Val Lys Glu Tyr Val Arg  
870 875 880

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Ser Gly Val Phe Gly Ser Asn Ser Tyr Asp Glu Leu Leu Gly Ser Leu  
885 890 895

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915 920 925

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Tyr	Asn	Val	Ser	Val	Ala
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Pro	Cys	Phe	Glu	Glu	Val
			875		880
Lys	Glu	Tyr	Val		
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Ser	Asn	Ser	Tyr	Asp	Glu
Leu	Leu	Gly	Ser		



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890

895

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Phe Ser Ser Asp Arg Thr Ile His Glu Tyr Ala Lys Asp Ile Trp Asp			
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atc agc cct gcc atc ctt ccc tag	2952		
Ile Ser Pro Ala Ile Leu Pro			
980			

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<400> 14

Gly Asp Asp His Leu Ala Ala Ala Ala Arg His Arg Leu Pro Pro
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Ala Arg Leu Leu Leu Arg Arg Trp Arg Gly Ser Pro Pro Arg Ala Val
20                      25                      30

Pro Glu Val Gly Ser Arg Arg Val Gly Val Gly Val Glu Gly Arg Leu
35                      40                      45

Gln Arg Arg Val Ser Ala Arg Ser Val Ala Ser Asp Arg Asp Val Gln  
50 55 60

Gly Pro Val Ser Pro Ala Glu Gly Leu Pro Asn Val Leu Asn Ser Ile  
65 70 75 80

Gly Ser Ser Ala Ile Ala Ser Asn Ile Lys His His Ala Glu Phe Ala  
85 90 95

Pro Leu Phe Ser Pro Asp His Phe Ser Pro Leu Lys Ala Tyr His Ala  
100 105 110

Thr Ala Lys Ser Val Leu Asp Ala Leu Leu Ile Asn Trp Asn Ala Thr  
115 120 125

Tyr Asp Tyr Tyr Asn Lys Met Asn Val Lys Gln Ala Tyr Tyr Leu Ser  
130 135 140

Met Glu Phe Leu Gln Gly Arg Ala Leu Thr Asn Ala Ile Gly Asn Leu  
145 150 155 160

Glu Ile Thr Gly Glu Tyr Ala Glu Ala Leu Lys Gln Leu Gly Gln Asn  
165 170 175

Leu Glu Asp Val Ala Ser Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly  
180 185 190

Gly Leu Gly Arg Leu Ala Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu  
195 200 205

Asn Tyr Pro Ala Leu Gly Tyr Gly Leu Arg Tyr Glu Tyr Gly Leu Phe  
210 215 220

Lys Gln Ile Ile Thr Lys Asp Gly Gln Glu Glu Ile Ala Glu Asn Trp  
225 230 235 240

Leu Glu Met Gly Tyr Pro Trp Glu Val Val Arg Asn Asp Val Ser Tyr  
245 250 255

Pro Val Lys Phe Tyr Gly Lys Val Val Glu Gly Thr Asp Gly Arg Lys  
260 265 270

His Trp Ile Gly Gly Glu Asn Ile Lys Ala Val Ala His Asp Val Pro  
275 280 285

Ile Pro Gly Tyr Lys Thr Arg Thr Thr Asn Asn Leu Arg Leu Trp Ser  
290 295 300

Thr Thr Val Pro Ala Gln Asp Phe Asp Leu Ala Ala Phe Asn Ser Gly  
305 310 315 320

Asp His Thr Lys Ala Tyr Glu Ala His Leu Asn Ala Lys Lys Ile Cys  
325 330 335

His Ile Leu Tyr Pro Gly Asp Glu Ser Leu Glu Gly Lys Val Leu Arg  
340 345 350

Leu Lys Gln Gln Tyr Thr Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile  
355 360 365

Ala Arg Phe Glu Ser Arg Ala Gly Glu Ser Leu Asn Trp Glu Asp Phe  
370 375 380

Pro Ser Lys Val Ala Val Gln Met Asn Asp Thr His Pro Thr Leu Cys  
385 390 395 400

Ile Pro Glu Leu Met Arg Ile Leu Met Asp Val Lys Gly Leu Ser Trp  
405 410 415

Ser Glu Ala Trp Ser Ile Thr Glu Arg Thr Val Ala Tyr Thr Asn His  
420 425 430

Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Leu Asp Ile Met Gln  
435 440 445

Lys Leu Leu Pro Arg His Val Glu Ile Ile Glu Thr Ile Asp Glu Glu  
450 455 460

Leu Ile Asn Asn Ile Val Ser Lys Tyr Gly Thr Thr Asp Thr Glu Leu  
465 470 475 480

Leu Lys Lys Lys Leu Lys Glu Met Arg Ile Leu Asp Asn Val Asp Leu  
485 490 495

Pro Ala Ser Ile Ser Gln Leu Phe Val Lys Pro Lys Asp Lys Lys Glu  
500 505 510

Ser Pro Ala Lys Ser Lys Gln Lys Leu Leu Val Lys Ser Leu Glu Thr  
515 520 525

Ile Val Glu Val Glu Glu Lys Thr Glu Leu Glu Glu Glu Ala Glu Val  
530 535 540

Leu Ser Glu Ile Glu Glu Glu Lys Leu Glu Ser Glu Glu Val Glu Ala  
545 550 555 560

Glu Glu Ala Ser Ser Glu Asp Glu Leu Asp Pro Phe Val Lys Ser Asp  
565 570 575

Pro Lys Leu Pro Arg Val Val Arg Met Ala Asn Leu Cys Val Val Gly  
580 585 590

Gly His Ser Val Asn Gly Val Ala Glu Ile His Ser Glu Ile Val Lys  
595 600 605

Gln Asp Val Phe Asn Ser Phe Tyr Glu Met Trp Pro Thr Lys Phe Gln  
610 615 620

Asn Lys Thr Asn Gly Val Thr Pro Arg Arg Trp Ile Arg Phe Cys Asn  
625 630 635 640

Pro Ala Leu Ser Ala Leu Ile Ser Lys Trp Ile Gly Ser Asp Asp Trp  
645 650 655

Val Leu Asn Thr Asp Lys Leu Ala Glu Leu Lys Lys Phe Ala Asp Asn  
660 665 670

Glu Asp Leu His Ser Glu Trp Arg Ala Ala Lys Lys Ala Asn Lys Met  
675 680 685

Lys Val Ile Ser Leu Ile Arg Glu Lys Thr Gly Tyr Ile Val Ser Pro  
690 695 700

Asp Ala Met Phe Asp Val Gln Val Lys Arg Ile His Glu Tyr Lys Arg  
705 710 715 720

Gln Leu Leu Asn Ile Leu Gly Ile Val Tyr Arg Tyr Lys Lys Met Lys  
725 730 735

Glu Met Ser Thr Glu Glu Arg Ala Lys Ser Phe Val Pro Arg Val Cys  
740 745 750

Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Ile Gln Ala Lys Arg Ile  
755 760 765



Val Lys Phe Ile Thr Asp Val Ala Ala Thr Val Asn His Asp Ser Asp  
770 775 780

Ile Gly Asp Leu Leu Lys Val Val Phe Val Pro Asp Tyr Asn Val Ser  
785 790 795 800

Val Ala Glu Ala Leu Ile Pro Ala Ser Glu Leu Ser Gln His Ile Ser  
805 810 815

Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Met  
820 825 830

Asn Gly Cys Ile Leu Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile  
835 840 845

Arg Glu Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Glu Ala  
850 855 860

His Glu Ile Ala Gly Leu Arg Lys Glu Arg Ala Glu Gly Lys Phe Val  
865 870 875 880

Pro Asp Pro Arg Phe Glu Glu Val Lys Glu Phe Val Arg Ser Gly Val  
885 890 895

Phe Gly Thr Tyr Ser Tyr Asp Glu Leu Met Gly Ser Leu Glu Gly Asn  
900 905 910

Glu Gly Tyr Gly Arg Ala Asp Tyr Phe Leu Val Gly Lys Asp Phe Pro  
915 920 925

Ser Tyr Ile Glu Cys Gln Glu Lys Val Asp Glu Ala Tyr Arg Asp Gln  
930 935 940

Lys Leu Trp Thr Arg Met Ser Ile Leu Asn Thr Ala Gly Ser Ser Lys  
945 950 955 960

Phe Ser Ser Asp Arg Thr Ile His Glu Tyr Ala Lys Asp Ile Trp Asp  
965 970 975

Ile Ser Pro Ala Ile Leu Pro  
980

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<213> Oryza sativa

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gaa gag att tca agt gtg cta aat tcc atc gat tcc tct acc att gca 97  
Glu Glu Ile Ser Ser Val Leu Asn Ser Ile Asp Ser Ser Thr Ile Ala  
20 25 30

tca aac att aag cac cat gcg gag ttc aca cca gta ttc tct cca gag 145  
Ser Asn Ile Lys His His Ala Glu Phe Thr Pro Val Phe Ser Pro Glu  
35 40 45

cac ttt tca cct ctg aag gct tac cat gca act gct aaa agt gtt ctt 193  
His Phe Ser Pro Leu Lys Ala Tyr His Ala Thr Ala Lys Ser Val Leu  
50 55 60

gat act ctg ata atg aac tgg aat gca aca tat gac tat tac gac aga 241  
Asp Thr Leu Ile Met Asn Trp Asn Ala Thr Tyr Asp Tyr Tyr Asp Arg  
65 70 75 80

aca aat gtg aag caa gcg tat tac ctg tcc atg gag ttt tta cag gga 289  
Thr Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu Gln Gly  
85 90 95

aga gct ctc act aat gcc gtt ggt aac ctt gag cta act gga caa tac 337  
Arg Ala Leu Thr Asn Ala Val Gly Asn Leu Glu Leu Thr Gly Gln Tyr  
100 105 110

gca gaa gca cta caa caa ctt gga cac agc cta gag gat gtt gct acc 385  
Ala Glu Ala Leu Gln Gln Leu Gly His Ser Leu Glu Asp Val Ala Thr  
115 120 125

cag gag cca gat gct gcc ctt ggg aat ggt ggt cta ggc cgg tta gct 433  
Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala  
130 135 140

tcc tgt ttc ttg gat tct ctg gca acc cta aat tat cca gca tgg gga 481  
Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala Trp Gly  
145 150 155 160

tat gga ctt cga tac aaa cat ggc ctc ttt aag caa atc ata acg aag 529  
Tyr Gly Leu Arg Tyr Lys His Gly Leu Phe Lys Gln Ile Ile Thr Lys  
165 170 175

gat ggt cag gag gag gta gct gaa aat tgg ctc gag atg gga aat cct 577  
Asp Gly Gln Glu Glu Val Ala Glu Asn Trp Leu Glu Met Gly Asn Pro  
180 185 190

tgg gag att gta aga acc gat gtc tcc tat cct gtg aag ttc tat ggt 625  
Trp Glu Ile Val Arg Thr Asp Val Ser Tyr Pro Val Lys Phe Tyr Gly  
195 200 205

aaa gtg gtt gaa ggc act gat ggg agg atg cac tgg att gga gga gaa 673  
 Lys Val Val Glu Gly Thr Asp Gly Arg Met His Trp Ile Gly Gly Glu  
 210 215 220

aat atc aag gtt gtt gct cat gat atc cct att cct ggc tac aag act 721  
 Asn Ile Lys Val Val Ala His Asp Ile Pro Ile Pro Gly Tyr Lys Thr  
 225 230 235 240

aaa act acc aac aat ctt cgt ctt tgg tca aca aca gtg cca tca caa 769  
 Lys Thr Thr Asn Asn Leu Arg Leu Trp Ser Thr Thr Val Pro Ser Gln  
 245 250 255

gat ttc gat ttg gaa gct ttt aat gct gga gat cat gca agt gca tat 817  
 Asp Phe Asp Leu Glu Ala Phe Asn Ala Gly Asp His Ala Ser Ala Tyr  
 260 265 270

gaa gct cat cta aat gct gaa aag ata tgt cac gta ctg tat cct ggg 865  
 Glu Ala His Leu Asn Ala Glu Lys Ile Cys His Val Leu Tyr Pro Gly  
 275 280 285

gac gaa tca cca gag ggg aaa gtt ctt cgc ctg aag caa caa tat aca 913  
 Asp Glu Ser Pro Glu Gly Lys Val Leu Arg Leu Lys Gln Gln Tyr Thr  
 290 295 300

tta tgc tca gcc tca cta cag gat att att gct cgt ttc gag agg aga 961  
 Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Ala Arg Phe Glu Arg Arg  
 305 310 315 320

gct ggt gat tct ctc agc tgg gag gac ttc ccc tct aaa gtt gca gtg 1009  
 Ala Gly Asp Ser Leu Ser Trp Glu Asp Phe Pro Ser Lys Val Ala Val  
 325 330 335

cag atg aat gac act cac cca aca ctg tgc att cct gag ttg atg aga 1057  
 Gln Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu Leu Met Arg  
 340 345 350

ata ttg att gat gtt aaa ggg tta agc tgg aat gag gct tgg agt atc 1105  
 Ile Leu Ile Asp Val Lys Gly Leu Ser Trp Asn Glu Ala Trp Ser Ile  
 355 360 365

aca gaa aga act gtg gca tac aca aac cac acg gtg ctt cct gaa gct 1153  
 Thr Glu Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala  
 370 375 380

ctg gag aag tgg agc ttg gac ata atg cag aaa ctt ctt cct cgg cat 1201  
 Leu Glu Lys Trp Ser Leu Asp Ile Met Gln Lys Leu Leu Pro Arg His  
 385 390 395 400

gtt gaa atc ata gaa aaa att gat ggg gag ctg atg aac atc att atc 1249  
 Val Glu Ile Ile Glu Lys Ile Asp Gly Glu Leu Met Asn Ile Ile Ile  
 405 410 415

tca aaa tac gga aca gaa gat act tca ctg tta aaa aag aag att aaa 1297  
 Ser Lys Tyr Gly Thr Glu Asp Thr Ser Leu Leu Lys Lys Lys Ile Lys  
 420 425 430

gaa atg aga atc tta gac aac att gac cta cca gat tct att gcc aaa 1345  
 Glu Met Arg Ile Leu Asp Asn Ile Asp Leu Pro Asp Ser Ile Ala Lys  
 435 440 445

cta ttt gtg aaa cca aaa gag aaa aaa gaa tct cct gct aaa ttg aaa 1393  
 Leu Phe Val Lys Pro Lys Glu Lys Lys Glu Ser Pro Ala Lys Leu Lys  
 450 455 460

gag aaa ttg ctt gtc aaa tct ctg gag cct agt gtt gtg gtt gag gag 1441  
 Glu Lys Leu Leu Val Lys Ser Leu Glu Pro Ser Val Val Val Glu Glu  
 465 470 475 480

aaa act gtg tcc aaa gta gag ata aac gag gac tct gag gag gtg gag 1489  
 Lys Thr Val Ser Lys Val Glu Ile Asn Glu Asp Ser Glu Glu Val Glu  
 485 490 495

gta gac tct gaa gaa gtt gtg gag gca gaa aac gag gac tct gag gat 1537  
 Val Asp Ser Glu Glu Val Val Glu Ala Glu Asn Glu Asp Ser Glu Asp  
 500 505 510

gag tta gat cca ttt gta aaa tca gat cct aaa tta cct aga gtt gtc 1585  
 Glu Leu Asp Pro Phe Val Lys Ser Asp Pro Lys Leu Pro Arg Val Val  
 515 520 525

cga atg gct aac ctt tgt gtt gtt ggt ggg cat tcg gtt aat ggt gtg 1633  
 Arg Met Ala Asn Leu Cys Val Val Gly Gly His Ser Val Asn Gly Val  
 530 535 540

gct gcg att cac agc gag att gtg aaa gaa gat gta ttc aac agc ttt 1681  
 Ala Ala Ile His Ser Glu Ile Val Lys Glu Asp Val Phe Asn Ser Phe  
 545 550 555 560

tat gag atg tgg ccc gct aaa ttt caa aat aaa aca aat gga gtg act 1729  
 Tyr Glu Met Trp Pro Ala Lys Phe Gln Asn Lys Thr Asn Gly Val Thr  
 565 570 575

cct aga cgt tgg att cgg ttt tgt aat cct gaa tta agt gca atc att 1777  
 Pro Arg Arg Trp Ile Arg Phe Cys Asn Pro Glu Leu Ser Ala Ile Ile  
 580 585 590

tca aaa tgg ata gga tct gat gat tgg gtt ttg aac act gat aaa ctt 1825  
 Ser Lys Trp Ile Gly Ser Asp Asp Trp Val Leu Asn Thr Asp Lys Leu  
 595 600 605

gct gaa tta aag aag ttt gct gat gat gag gat ctg caa tca gaa tgg 1873  
 Ala Glu Leu Lys Lys Phe Ala Asp Asp Glu Asp Leu Gln Ser Glu Trp  
 610 615 620

cgt gct gct aaa aag gct aac aag gtg aag gtt gtt tct ctc ata aga 1921  
 Arg Ala Ala Lys Lys Ala Asn Lys Val Lys Val Val Ser Leu Ile Arg  
 625 630 635 640

gaa aaa aca gga tat atc gtc agt cca gat gca atg ttt gac gtt cag 1969  
 Glu Lys Thr Gly Tyr Ile Val Ser Pro Asp Ala Met Phe Asp Val Gln  
 645 650 655

gtg aaa agg atc cat gag tat aag cga cag ctg cta aat atc ctt gga 2017  
 Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly  
 660 665 670

att gtc tac cgc tac aag aag atg aaa gaa atg agt gca aaa gac aga 2065  
 Ile Val Tyr Arg Tyr Lys Lys Met Lys Glu Met Ser Ala Lys Asp Arg  
 675 680 685

ata aat agc ttt gtt cca agg gta tgc ata ttt ggt ggg aaa gca ttt 2113  
 Ile Asn Ser Phe Val Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe  
 690 695 700

gcc act tac gta cag gca aag agg ata gtg aag ttt att aca gat gtt 2161  
 Ala Thr Tyr Val Gln Ala Lys Arg Ile Val Lys Phe Ile Thr Asp Val  
 705 710 715 720

gca gct act gta aat cat gat cca gaa att gga gat cta ttg aag gtt 2209  
 Ala Ala Thr Val Asn His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val  
 725 730 735

gta ttt att cca gat tat aat gtt agt gtt gct gag gcg cta atc cct 2257  
 Val Phe Ile Pro Asp Tyr Asn Val Ser Val Ala Glu Ala Leu Ile Pro  
 740 745 750

gcc agt gaa ttg tct cag cat atc agt act gct gga atg gaa gct agt 2305  
 Ala Ser Glu Leu Ser Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser  
 755 760 765

gga acc agc aac atg aag ttt gca atg aat gga tgt atc ctt att gga 2353  
 Gly Thr Ser Asn Met Lys Phe Ala Met Asn Gly Cys Ile Leu Ile Gly  
 770 775 780

act ttg gat ggt gct aat gtg gaa atc aga gag gag gtt gga gag gaa 2401  
 Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu Glu Val Gly Glu Glu  
 785 790 795 800

aac ttt ttc ctt ttt ggt gct gag gca cat gaa att gct ggt tta agg 2449  
 Asn Phe Phe Leu Phe Gly Ala Glu Ala His Glu Ile Ala Gly Leu Arg  
 805 810 815

aaa gag aga gcc cag gga aag ttt gtg cct gac cca aga ttc gaa gag 2497  
 Lys Glu Arg Ala Gln Gly Lys Phe Val Pro Asp Pro Arg Phe Glu Glu  
 820 825 830

gtt aag aga ttt gtc cgc agt ggg gtc ttt gga act tac aac tac gat 2545  
 Val Lys Arg Phe Val Arg Ser Gly Val Phe Gly Thr Tyr Asn Tyr Asp  
 835 840 845

gac ttg atg ggt tct ctg gaa gga aat gaa ggt tat ggg cgt gca gac 2593  
 Asp Leu Met Gly Ser Leu Glu Gly Asn Glu Gly Tyr Gly Arg Ala Asp  
 850 855 860

tat ttt ctt gtt ggt aaa gat ttc ccc agc tac att gaa tgc cag gag 2641  
 Tyr Phe Leu Val Gly Lys Asp Phe Pro Ser Tyr Ile Glu Cys Gln Glu  
 865 870 875 880

aag gtt gat aaa gca tac cgc gat cag aaa cta tgg aca agg atg tca 2689  
 Lys Val Asp Lys Ala Tyr Arg Asp Gln Lys Leu Trp Thr Arg Met Ser  
 885 890 895

atc ctc aac aca gcc agt tcc tcc aag ttc aac agc gac cgg acg att 2737  
 Ile Leu Asn Thr Ala Ser Ser Ser Lys Phe Asn Ser Asp Arg Thr Ile  
 900 905 910

cac gag tac gcc aag gac atc tgg gac atc aag cct gtc atc ctg ccc 2785  
 His Glu Tyr Ala Lys Asp Ile Trp Asp Ile Lys Pro Val Ile Leu Pro  
 915 920 925

tag acaggcaagg caagcactag ccactccctg ccagcgacct tcagagctaa 2838  
 ggtgcgcgca accggtgatg cgatgacagc atctgcctcc cagctctcct tggcaggaag 2898  
 gtttcgcttt gctcccagtt ttgagtagac agaagcaagt tcagttcagg ctgcgataaa 2958  
 acgctggaac tatgcaaatt gtagccgtgt tgcctagcct ggaacaccct tgttttacct 3018  
 gtaatgtgta gcagcctctg ctgatcagct catgtgctat atggaattct gaagtgaac 3078  
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 aaa 3141

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 <213> Oryza sativa

<400> 16

Arg Ser Val Ala Ser Asp Arg Gly Val Gln Gly Ser Val Ser Pro Glu  
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Glu Glu Ile Ser Ser Val Leu Asn Ser Ile Asp Ser Ser Thr Ile Ala  
 20 25 30

Ser Asn Ile Lys His His Ala Glu Phe Thr Pro Val Phe Ser Pro Glu  
 35 40 45

His Phe Ser Pro Leu Lys Ala Tyr His Ala Thr Ala Lys Ser Val Leu  
 50 55 60

Asp Thr Leu Ile Met Asn Trp Asn Ala Thr Tyr Asp Tyr Tyr Asp Arg  
 65 70 75 80

Thr Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu Gln Gly  
 85 90 95

Arg Ala Leu Thr Asn Ala Val Gly Asn Leu Glu Leu Thr Gly Gln Tyr  
 100 105 110

Ala Glu Ala Leu Gln Gln Leu Gly His Ser Leu Glu Asp Val Ala Thr  
 115 120 125

Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala  
 130 135 140

Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala Trp Gly

145                    150                    155                    160

Tyr Gly Leu Arg Tyr Lys His Gly Leu Phe Lys Gln Ile Ile Thr Lys  
                  165                    170                    175

Asp Gly Gln Glu Glu Val Ala Glu Asn Trp Leu Glu Met Gly Asn Pro  
                  180                    185                    190

Trp Glu Ile Val Arg Thr Asp Val Ser Tyr Pro Val Lys Phe Tyr Gly  
                  195                    200                    205

Lys Val Val Glu Gly Thr Asp Gly Arg Met His Trp Ile Gly Gly Glu  
                  210                    215                    220

Asn Ile Lys Val Val Ala His Asp Ile Pro Ile Pro Gly Tyr Lys Thr  
                  225                    230                    235                    240

Lys Thr Thr Asn Asn Leu Arg Leu Trp Ser Thr Thr Val Pro Ser Gln  
                  245                    250                    255

Asp Phe Asp Leu Glu Ala Phe Asn Ala Gly Asp His Ala Ser Ala Tyr  
                  260                    265                    270

Glu Ala His Leu Asn Ala Glu Lys Ile Cys His Val Leu Tyr Pro Gly  
                  275                    280                    285

Asp Glu Ser Pro Glu Gly Lys Val Leu Arg Leu Lys Gln Gln Tyr Thr  
                  290                    295                    300

Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Ala Arg Phe Glu Arg Arg  
                  305                    310                    315                    320

Ala Gly Asp Ser Leu Ser Trp Glu Asp Phe Pro Ser Lys Val Ala Val  
                  325                    330                    335

Gln Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu Leu Met Arg  
                  340                    345                    350

Ile Leu Ile Asp Val Lys Gly Leu Ser Trp Asn Glu Ala Trp Ser Ile  
                  355                    360                    365

Thr Glu Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala  
                  370                    375                    380

Leu Glu Lys Trp Ser Leu Asp Ile Met Gln Lys Leu Leu Pro Arg His

385	390	395	400
Val Glu Ile Ile Glu Lys Ile Asp Gly Glu Leu Met Asn Ile Ile Ile			
405	410	415	
Ser Lys Tyr Gly Thr Glu Asp Thr Ser Leu Leu Lys Lys Lys Ile Lys			
420	425	430	
Glu Met Arg Ile Leu Asp Asn Ile Asp Leu Pro Asp Ser Ile Ala Lys			
435	440	445	
Leu Phe Val Lys Pro Lys Glu Lys Lys Glu Ser Pro Ala Lys Leu Lys			
450	455	460	
Glu Lys Leu Leu Val Lys Ser Leu Glu Pro Ser Val Val Val Glu Glu			
465	470	475	480
Lys Thr Val Ser Lys Val Glu Ile Asn Glu Asp Ser Glu Glu Val Glu			
485	490	495	
Val Asp Ser Glu Glu Val Val Glu Ala Glu Asn Glu Asp Ser Glu Asp			
500	505	510	
Glu Leu Asp Pro Phe Val Lys Ser Asp Pro Lys Leu Pro Arg Val Val			
515	520	525	
Arg Met Ala Asn Leu Cys Val Val Gly Gly His Ser Val Asn Gly Val			
530	535	540	
Ala Ala Ile His Ser Glu Ile Val Lys Glu Asp Val Phe Asn Ser Phe			
545	550	555	560
Tyr Glu Met Trp Pro Ala Lys Phe Gln Asn Lys Thr Asn Gly Val Thr			
565	570	575	
Pro Arg Arg Trp Ile Arg Phe Cys Asn Pro Glu Leu Ser Ala Ile Ile			
580	585	590	
Ser Lys Trp Ile Gly Ser Asp Asp Trp Val Leu Asn Thr Asp Lys Leu			
595	600	605	
Ala Glu Leu Lys Lys Phe Ala Asp Asp Glu Asp Leu Gln Ser Glu Trp			
610	615	620	
Arg Ala Ala Lys Lys Ala Asn Lys Val Lys Val Val Ser Leu Ile Arg			



625	630	635	640
Glu Lys Thr Gly Tyr Ile Val Ser Pro Asp Ala Met Phe Asp Val Gln			
645	650	655	
Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly			
660	665	670	
Ile Val Tyr Arg Tyr Lys Lys Met Lys Glu Met Ser Ala Lys Asp Arg			
675	680	685	
Ile Asn Ser Phe Val Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe			
690	695	700	
Ala Thr Tyr Val Gln Ala Lys Arg Ile Val Lys Phe Ile Thr Asp Val			
705	710	715	720
Ala Ala Thr Val Asn His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val			
725	730	735	
Val Phe Ile Pro Asp Tyr Asn Val Ser Val Ala Glu Ala Leu Ile Pro			
740	745	750	
Ala Ser Glu Leu Ser Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser			
755	760	765	
Gly Thr Ser Asn Met Lys Phe Ala Met Asn Gly Cys Ile Leu Ile Gly			
770	775	780	
Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu Glu Val Gly Glu Glu			
785	790	795	800
Asn Phe Phe Leu Phe Gly Ala Glu Ala His Glu Ile Ala Gly Leu Arg			
805	810	815	
Lys Glu Arg Ala Gln Gly Lys Phe Val Pro Asp Pro Arg Phe Glu Glu			
820	825	830	
Val Lys Arg Phe Val Arg Ser Gly Val Phe Gly Thr Tyr Asn Tyr Asp			
835	840	845	
Asp Leu Met Gly Ser Leu Glu Gly Asn Glu Gly Tyr Gly Arg Ala Asp			
850	855	860	
Tyr Phe Leu Val Gly Lys Asp Phe Pro Ser Tyr Ile Glu Cys Gln Glu			

865                      870                      875                      880

Lys Val Asp Lys Ala Tyr Arg Asp Gln Lys Leu Trp Thr Arg Met Ser  
                     885                      890                      895

Ile Leu Asn Thr Ala Ser Ser Ser Lys Phe Asn Ser Asp Arg Thr Ile  
                     900                      905                      910

His Glu Tyr Ala Lys Asp Ile Trp Asp Ile Lys Pro Val Ile Leu Pro  
                     915                      920                      925

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 <212> DNA  
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 Met Ala Thr Ala Ser Ala Pro Leu Gln Leu Ala Thr Ala Ser Arg Pro  
 1                      5                      10                      15

ctc ccc gtc ggc gtc ggc tgc ggc gga gga ggc ggg ggg ctc cac 96  
 Leu Pro Val Gly Val Gly Cys Gly Gly Gly Gly Gly Gly Gly Leu His  
                     20                      25                      30

gtg ggt ggt gcc cgc ggc ggg ggc gcg gca ccg gcg cgg cgg cgg ctg 144  
 Val Gly Gly Ala Arg Gly Gly Gly Ala Ala Pro Ala Arg Arg Arg Leu  
                     35                      40                      45

gcg gtg cgg agc gtg gcg agc gat cgg ggc gtg cag ggg tcg gtg tcg 192  
 Ala Val Arg Ser Val Ala Ser Asp Arg Gly Val Gln Gly Ser Val Ser  
                     50                      55                      60

ccc gag gaa gag att tca agt gtg cta aat tcc atc gat tcc tct acc 240  
 Pro Glu Glu Glu Ile Ser Ser Val Leu Asn Ser Ile Asp Ser Ser Thr  
 65                      70                      75                      80

att gca tca aac att aag cac cat gcg gag ttc aca cca gta ttc tct 288  
 Ile Ala Ser Asn Ile Lys His His Ala Glu Phe Thr Pro Val Phe Ser  
                     85                      90                      95

cca gag cac ttt tca cct ctg aag gct tac cat gca act gct aaa agt 336  
 Pro Glu His Phe Ser Pro Leu Lys Ala Tyr His Ala Thr Ala Lys Ser  
                     100                      105                      110

gtt ctt gat act ctg ata atg aac tgg aat gca aca tat gac tat tac 384  
 Val Leu Asp Thr Leu Ile Met Asn Trp Asn Ala Thr Tyr Asp Tyr Tyr  
                     115                      120                      125

gac aga aca aat gtg aag caa gcg tat tac ctg tcc atg gag ttt tta 432  
 Asp Arg Thr Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu

130	135	140	
cag gga aga gct ctc act aat gcc gtt ggt aac ctt gag cta act gga	480		
Gln Gly Arg Ala Leu Thr Asn Ala Val Gly Asn Leu Glu Leu Thr Gly			
145	150	155	160
caa tac gca gaa gca cta caa caa ctt gga cac agc cta gag gat gtt	528		
Gln Tyr Ala Glu Ala Leu Gln Gln Leu Gly His Ser Leu Glu Asp Val			
165	170	175	
gct acc cag gag cca gat gct gcc ctt ggg aat ggt ggt cta ggc cgg	576		
Ala Thr Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg			
180	185	190	
tta gct tcc tgt ttc ttg gat tct ctg gca acc cta aat tat cca gca	624		
Leu Ala Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala			
195	200	205	
tgg gga tat gga ctt cga tac aaa cat ggc ctc ttt aaa gca aat cat	672		
Trp Gly Tyr Gly Leu Arg Tyr Lys His Gly Leu Phe Lys Ala Asn His			
210	215	220	
acg aag gat ggt cag gag gag gta gct gaa aat tgg ctc gag atg gga	720		
Thr Lys Asp Gly Gln Glu Glu Val Ala Glu Asn Trp Leu Glu Met Gly			
225	230	235	240
aat cct tgg gag att gta aga acc gat gtc tcc tat cct gtg aag ttc	768		
Asn Pro Trp Glu Ile Val Arg Thr Asp Val Ser Tyr Pro Val Lys Phe			
245	250	255	
tat ggt aaa gtg gtt gaa ggc act gat ggg agg atg cac tgg att gga	816		
Tyr Gly Lys Val Val Glu Gly Thr Asp Gly Arg Met His Trp Ile Gly			
260	265	270	
gga gaa aat atc aag gtt gtt gct cat gat atc cct att cct ggc tac	864		
Gly Glu Asn Ile Lys Val Val Ala His Asp Ile Pro Ile Pro Gly Tyr			
275	280	285	
aag act aaa act acc aac aat ctt cgt ctt tgg tca aca aca gtg cca	912		
Lys Thr Lys Thr Thr Asn Asn Leu Arg Leu Trp Ser Thr Thr Val Pro			
290	295	300	
tca caa gat ttc gat ttg gaa gct ttt aat gct gga gat cat gca agt	960		
Ser Gln Asp Phe Asp Leu Glu Ala Phe Asn Ala Gly Asp His Ala Ser			
305	310	315	320
gca tat gaa gct cat cta aat gct gaa aag cct cac tac agg gat att	1008		
Ala Tyr Glu Ala His Leu Asn Ala Glu Lys Pro His Tyr Arg Asp Ile			
325	330	335	
att gct cgt ttc gag agg aga gct ggt gat tct ctc agc tgg gag gac	1056		
Ile Ala Arg Phe Glu Arg Arg Ala Gly Asp Ser Leu Ser Trp Glu Asp			
340	345	350	
ttc ccc tct aaa gtt gca gtg cag atg aat gac act cac cca aca ctg	1104		
Phe Pro Ser Lys Val Ala Val Gln Met Asn Asp Thr His Pro Thr Leu			
355	360	365	
tgc att cct gag ttg atg aga ata ttg att gat gtt aaa ggg tta agc	1152		
Cys Ile Pro Glu Leu Met Arg Ile Leu Ile Asp Val Lys Gly Leu Ser			

370	375	380	
tgg aat gag gct tgg agt atc aca gaa aga act gtg gca tac aca aac	1200		
Trp Asn Glu Ala Trp Ser Ile Thr Glu Arg Thr Val Ala Tyr Thr Asn			
385                      390                      395                      400			
cac acg gtg ctt cct gaa gct ctg gag aag tgg agc ttg gac ata atg	1248		
His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Leu Asp Ile Met			
405                      410                      415			
cag aaa ctt ctt cct cgg cat gtt gaa atc ata gaa aaa att gat ggg	1296		
Gln Lys Leu Leu Pro Arg His Val Glu Ile Ile Glu Lys Ile Asp Gly			
420                      425                      430			
gag ctg atg aac atc att atc tca aaa tac gga aca gaa gat act tca	1344		
Glu Leu Met Asn Ile Ile Ile Ser Lys Tyr Gly Thr Glu Asp Thr Ser			
435                      440                      445			
ctg tta aaa aag aag att aaa gaa atg aga atc tta gac aac att gac	1392		
Leu Leu Lys Lys Lys Ile Lys Glu Met Arg Ile Leu Asp Asn Ile Asp			
450                      455                      460			
cta cca gat tct att gcc aaa cta ttt gtg aaa cca aaa gag aaa aaa	1440		
Leu Pro Asp Ser Ile Ala Lys Leu Phe Val Lys Pro Lys Glu Lys Lys			
465                      470                      475                      480			
gaa tct cct gct aaa ttg aaa gag aaa ttg ctt gtc aaa tct ctg gag	1488		
Glu Ser Pro Ala Lys Leu Lys Glu Lys Leu Leu Val Lys Ser Leu Glu			
485                      490                      495			
cct agt gtt gtg gtt gag gag aaa act gtg tcc aaa gta gag ata aac	1536		
Pro Ser Val Val Val Glu Glu Lys Thr Val Ser Lys Val Glu Ile Asn			
500                      505                      510			
gag gac tct gag gag gtg gag gta gac tct gaa gaa gtt gtg gag gca	1584		
Glu Asp Ser Glu Glu Val Glu Val Asp Ser Glu Glu Val Val Glu Ala			
515                      520                      525			
gaa aac gag gac tct gag gat gag tta gat cca ttt gta aaa tca gat	1632		
Glu Asn Glu Asp Ser Glu Asp Glu Leu Asp Pro Phe Val Lys Ser Asp			
530                      535                      540			
cct aaa tta cct aga gtt gtc cga atg gct aac ctt tgt gtt gtt ggt	1680		
Pro Lys Leu Pro Arg Val Val Arg Met Ala Asn Leu Cys Val Val Gly			
545                      550                      555                      560			
ggg cat tcg gtt aat ggt gtg gct gcg att cac agc gag att gtg aaa	1728		
Gly His Ser Val Asn Gly Val Ala Ala Ile His Ser Glu Ile Val Lys			
565                      570                      575			
gaa gat gta ttc aac agc ttt tat gag atg tgg ccc gct aaa ttt caa	1776		
Glu Asp Val Phe Asn Ser Phe Tyr Glu Met Trp Pro Ala Lys Phe Gln			
580                      585                      590			
aat aaa aca aat gga gtg act cct aga cgt tgg att cgg ttt tgt aat	1824		
Asn Lys Thr Asn Gly Val Thr Pro Arg Arg Trp Ile Arg Phe Cys Asn			
595                      600                      605			
cct gaa tta agt gca atc att tca aaa tgg ata gga tct gat gat tgg	1872		
Pro Glu Leu Ser Ala Ile Ile Ser Lys Trp Ile Gly Ser Asp Asp Trp			

610	615	620	
gtt ttg aac act gat aaa ctt gct gaa tta aag aag ttt gct gat gat 1920			
Val Leu Asn Thr Asp Lys Leu Ala Glu Leu Lys Lys Phe Ala Asp Asp			
625	630	635	640
gag gat ctg caa tca gaa tgg cgt gct gct aaa aag gct aac aag gtg 1968			
Glu Asp Leu Gln Ser Glu Trp Arg Ala Ala Lys Lys Ala Asn Lys Val			
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aag gtt gtt tct ctc ata aga gaa aaa aca gga tat atc gtc agt cca 2016			
Lys Val Val Ser Leu Ile Arg Glu Lys Thr Gly Tyr Ile Val Ser Pro			
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gat gca atg ttt gac gtt cag gtg aaa agg atc cat gag tat aag cga 2064			
Asp Ala Met Phe Asp Val Gln Val Lys Arg Ile His Glu Tyr Lys Arg			
675	680	685	
cag ctg cta aat atc ctt gga att gtc tac cgc tac aag aag atg aaa 2112			
Gln Leu Leu Asn Ile Leu Gly Ile Val Tyr Arg Tyr Lys Lys Met Lys			
690	695	700	
gaa atg agt gca aaa gac aga ata aat agc ttt gtt cca agg gta tgc 2160			
Glu Met Ser Ala Lys Asp Arg Ile Asn Ser Phe Val Pro Arg Val Cys			
705	710	715	720
ata ttt ggt ggg aaa gca ttt gcc act tac gta cag gca aag agg ata 2208			
Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln Ala Lys Arg Ile			
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gtg aag ttt att aca gat gtt gca gct act gta aat cat gat cca gaa 2256			
Val Lys Phe Ile Thr Asp Val Ala Ala Thr Val Asn His Asp Pro Glu			
740	745	750	
att gga gat cta ttg aag gtt gta ttt att cca gat tat aat gtt agt 2304			
Ile Gly Asp Leu Leu Lys Val Val Phe Ile Pro Asp Tyr Asn Val Ser			
755	760	765	
gtt gct gag gcg cta atc cct gcc agt gaa ttg tct cag cat atc agt 2352			
Val Ala Glu Ala Leu Ile Pro Ala Ser Glu Leu Ser Gln His Ile Ser			
770	775	780	
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Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Met			
785	790	795	800
aat gga tgt atc ctt att gga act ttg gat ggt gct aat gtg gaa atc 2448			
Asn Gly Cys Ile Leu Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile			
805	810	815	
aga gag gag gtt gga gag gaa aac ttt ttc ctt ttt ggt gct gag gca 2496			
Arg Glu Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Glu Ala			
820	825	830	
cat gaa att gct ggt tta agg aaa gag aga gcc cag gga aag ttt gtg 2544			
His Glu Ile Ala Gly Leu Arg Lys Glu Arg Ala Gln Gly Lys Phe Val			
835	840	845	
cct gac cca aga ttc gaa gag gtt aag aga ttt gtc cgc agt ggg gtc 2592			
Pro Asp Pro Arg Phe Glu Glu Val Lys Arg Phe Val Arg Ser Gly Val			

850

855

860

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gaa ggt tat ggg cgt gca gac tat ttt ctt gtt ggt aaa gat ttc ccc 2688  
 Glu Gly Tyr Gly Arg Ala Asp Tyr Phe Leu Val Gly Lys Asp Phe Pro  
 885 890 895

agc tac att gaa tgc cag gag aag gtt gat aaa gca tac cgc gat cag 2736  
 Ser Tyr Ile Glu Cys Gln Glu Lys Val Asp Lys Ala Tyr Arg Asp Gln  
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aaa cta tgg aca agg atg tca atc ctc aac aca gcc agt tcc tcc aag 2784  
 Lys Leu Trp Thr Arg Met Ser Ile Leu Asn Thr Ala Ser Ser Ser Lys  
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Val Gly Gly Ala Arg Gly Gly Gly Ala Ala Pro Ala Arg Arg Arg Leu  
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Ala Val Arg Ser Val Ala Ser Asp Arg Gly Val Gln Gly Ser Val Ser  
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Pro Glu Glu Glu Ile Ser Ser Val Leu Asn Ser Ile Asp Ser Ser Thr  
 65 70 75 80

Ile Ala Ser Asn Ile Lys His His Ala Glu Phe Thr Pro Val Phe Ser  
 85 90 95

Pro Glu His Phe Ser Pro Leu Lys Ala Tyr His Ala Thr Ala Lys Ser  
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Val Leu Asp Thr Leu Ile Met Asn Trp Asn Ala Thr Tyr Asp Tyr Tyr  
115 120 125

Asp Arg Thr Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu  
130 135 140

Gln Gly Arg Ala Leu Thr Asn Ala Val Gly Asn Leu Glu Leu Thr Gly  
145 150 155 160

Gln Tyr Ala Glu Ala Leu Gln Gln Leu Gly His Ser Leu Glu Asp Val  
165 170 175

Ala Thr Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg  
180 185 190

Leu Ala Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala  
195 200 205

Trp Gly Tyr Gly Leu Arg Tyr Lys His Gly Leu Phe Lys Ala Asn His  
210 215 220

Thr Lys Asp Gly Gln Glu Glu Val Ala Glu Asn Trp Leu Glu Met Gly  
225 230 235 240

Asn Pro Trp Glu Ile Val Arg Thr Asp Val Ser Tyr Pro Val Lys Phe  
245 250 255

Tyr Gly Lys Val Val Glu Gly Thr Asp Gly Arg Met His Trp Ile Gly  
260 265 270

Gly Glu Asn Ile Lys Val Val Ala His Asp Ile Pro Ile Pro Gly Tyr  
275 280 285

Lys Thr Lys Thr Thr Asn Asn Leu Arg Leu Trp Ser Thr Thr Val Pro  
290 295 300

Ser Gln Asp Phe Asp Leu Glu Ala Phe Asn Ala Gly Asp His Ala Ser  
305 310 315 320

Ala Tyr Glu Ala His Leu Asn Ala Glu Lys Pro His Tyr Arg Asp Ile  
325 330 335

Ile Ala Arg Phe Glu Arg Arg Ala Gly Asp Ser Leu Ser Trp Glu Asp  
340 345 350

Phe Pro Ser Lys Val Ala Val Gln Met Asn Asp Thr His Pro Thr Leu  
355 360 365

Cys Ile Pro Glu Leu Met Arg Ile Leu Ile Asp Val Lys Gly Leu Ser  
370 375 380

Trp Asn Glu Ala Trp Ser Ile Thr Glu Arg Thr Val Ala Tyr Thr Asn  
385 390 395 400

His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Leu Asp Ile Met  
405 410 415

Gln Lys Leu Leu Pro Arg His Val Glu Ile Ile Glu Lys Ile Asp Gly  
420 425 430

Glu Leu Met Asn Ile Ile Ile Ser Lys Tyr Gly Thr Glu Asp Thr Ser  
435 440 445

Leu Leu Lys Lys Lys Ile Lys Glu Met Arg Ile Leu Asp Asn Ile Asp  
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Glu Ser Pro Ala Lys Leu Lys Glu Lys Leu Leu Val Lys Ser Leu Glu  
485 490 495

Pro Ser Val Val Val Glu Glu Lys Thr Val Ser Lys Val Glu Ile Asn  
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Glu Asp Ser Glu Glu Val Glu Val Asp Ser Glu Glu Val Val Glu Ala  
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Glu Asn Glu Asp Ser Glu Asp Glu Leu Asp Pro Phe Val Lys Ser Asp  
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Pro Lys Leu Pro Arg Val Val Arg Met Ala Asn Leu Cys Val Val Gly  
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Gly His Ser Val Asn Gly Val Ala Ala Ile His Ser Glu Ile Val Lys  
565 570 575

Glu Asp Val Phe Asn Ser Phe Tyr Glu Met Trp Pro Ala Lys Phe Gln  
580 585 590



Asn Lys Thr Asn Gly Val Thr Pro Arg Arg Trp Ile Arg Phe Cys Asn  
595 600 605

Pro Glu Leu Ser Ala Ile Ile Ser Lys Trp Ile Gly Ser Asp Asp Trp  
610 615 620

Val Leu Asn Thr Asp Lys Leu Ala Glu Leu Lys Lys Phe Ala Asp Asp  
625 630 635 640

Glu Asp Leu Gln Ser Glu Trp Arg Ala Ala Lys Lys Ala Asn Lys Val  
645 650 655

Lys Val Val Ser Leu Ile Arg Glu Lys Thr Gly Tyr Ile Val Ser Pro  
660 665 670

Asp Ala Met Phe Asp Val Gln Val Lys Arg Ile His Glu Tyr Lys Arg  
675 680 685

Gln Leu Leu Asn Ile Leu Gly Ile Val Tyr Arg Tyr Lys Lys Met Lys  
690 695 700

Glu Met Ser Ala Lys Asp Arg Ile Asn Ser Phe Val Pro Arg Val Cys  
705 710 715 720

Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln Ala Lys Arg Ile  
725 730 735

Val Lys Phe Ile Thr Asp Val Ala Ala Thr Val Asn His Asp Pro Glu  
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Ile Gly Asp Leu Leu Lys Val Val Phe Ile Pro Asp Tyr Asn Val Ser  
755 760 765

Val Ala Glu Ala Leu Ile Pro Ala Ser Glu Leu Ser Gln His Ile Ser  
770 775 780

Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Met  
785 790 795 800

Asn Gly Cys Ile Leu Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile  
805 810 815

Arg Glu Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Glu Ala  
820 825 830

His Glu Ile Ala Gly Leu Arg Lys Glu Arg Ala Gln Gly Lys Phe Val  
835 840 845

Pro Asp Pro Arg Phe Glu Glu Val Lys Arg Phe Val Arg Ser Gly Val  
850 855 860

Phe Gly Thr Tyr Asn Tyr Asp Asp Leu Met Gly Ser Leu Glu Gly Asn  
865 870 875 880

Glu Gly Tyr Gly Arg Ala Asp Tyr Phe Leu Val Gly Lys Asp Phe Pro  
885 890 895

Ser Tyr Ile Glu Cys Gln Glu Lys Val Asp Lys Ala Tyr Arg Asp Gln  
900 905 910

Lys Leu Trp Thr Arg Met Ser Ile Leu Asn Thr Ala Ser Ser Ser Lys  
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Asp Pro Ser Ala Ile Ala Phe Asn Ile Ser Tyr His Ala Gln Tyr Ser  
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ccc cac ttc tgg ccg ctc gcc ttc ggc ccc gag cag gcc ttc tac gcc 201  
Pro His Phe Ser Pro Leu Ala Phe Gly Pro Glu Gln Ala Phe Tyr Ala  
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acc gcc gag agc gtc cgc gac cac ctc ctc cag aga tgg aac gac acc 249

Thr Ala Glu Ser Val Arg Asp His Leu Leu Gln Arg Trp Asn Asp Thr  
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tac ctg cat ttc cac aag acg gat ccc aag cag acc tac tac ctc tcc 297  
Tyr Leu His Phe His Lys Thr Asp Pro Lys Gln Thr Tyr Tyr Leu Ser  
65 70 75 80

atg gag tac ctg cag ggc cgc gcg ctc acc aac gcc gtc ggc aac ctc 345  
Met Glu Tyr Leu Gln Gly Arg Ala Leu Thr Asn Ala Val Gly Asn Leu  
85 90 95

gcc atc acc ggc gcc tac gct gac gcc ctg aag aag ttc ggc tac gag 393  
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100 105 110

ctc gag gcc atc gct gga cag gag aga gat gcg gct ctg gga aat ggt 441  
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115 120 125

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Gly Leu Gly Arg Leu Ala Ser Cys Phe Leu Asp Ser Met Ala Thr Leu  
130 135 140

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Asn Leu Pro Ser Trp Gly Tyr Gly Leu Arg Tyr Arg Tyr Gly Leu Phe  
145 150 155 160

aag cag cgc att gcc aag gaa gga caa gaa gaa atc gct gaa gat tgg 585  
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165 170 175

ctt gat aag ttt agc cca tgg gag att gtc agg cat gat gtt gta tac 633  
Leu Asp Lys Phe Ser Pro Trp Glu Ile Val Arg His Asp Val Val Tyr  
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210 215 220

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Ile Pro Gly Tyr Lys Thr Lys Asn Ala Ile Ser Leu Arg Leu Trp Asp  
225 230 235 240

gca aca gct act gct gag gat ttc aac tta ttt cag ttc aat gat ggc 825  
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245 250 255

cag tat gag tca gct gct caa ctt cac tcg agg gca cag cag ata tgt 873  
Gln Tyr Glu Ser Ala Ala Gln Leu His Ser Arg Ala Gln Gln Ile Cys  
260 265 270

gct gtt ctc tat ccc ggt gat gct aca gaa gaa ggg aag ctt ctg aga 921  
Ala Val Leu Tyr Pro Gly Asp Ala Thr Glu Glu Gly Lys Leu Leu Arg  
275 280 285

tta aag cag cag tat ttc ctt tgc agc gca tca ctt cag gat att att 969

Leu Lys Gln Gln Tyr Phe Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile  
290 295 300

ttc aga ttt aaa gaa aga aaa gct gac aga gtt tca ggg aag tgg agt 1017  
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305 310 315 320

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325 330 335

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340 345 350

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Gly Trp Asp Glu Ala Trp Ala Val Thr Asn Lys Thr Val Ala Tyr Thr  
355 360 365

aat cac acg gtt ctt cct gaa gct ctt gag aaa tgg tca cag gct gta 1209  
Asn His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Gln Ala Val  
370 375 380

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385 390 395 400

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405 410 415

aag atc gaa tcg atg agg gtt tta gat aac aat ccc gag aag cca gta 1353  
Lys Ile Glu Ser Met Arg Val Leu Asp Asn Asn Pro Glu Lys Pro Val  
420 425 430

gtg cgg atg gcg aat ttg tgt gtt gtg gct ggg cat acg gtg aat gga 1401  
Val Arg Met Ala Asn Leu Cys Val Val Ala Gly His Thr Val Asn Gly  
435 440 445

gtg gcc gag ttg cac agc aac atc ttg aaa caa gag ctg ttt gca gat 1449  
Val Ala Glu Leu His Ser Asn Ile Leu Lys Gln Glu Leu Phe Ala Asp  
450 455 460

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Tyr Val Ser Ile Trp Pro Asn Lys Phe Gln Asn Lys Thr Asn Gly Ile  
465 470 475 480

aca cca cgt aga tgg ctc cgt ttt tgc aac cct gag ttg agt gaa ata 1545  
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485 490 495

gtc act aaa tgg cta aaa aca gat cag tgg aca agc aac ctt gat ctt 1593  
Val Thr Lys Trp Leu Lys Thr Asp Gln Trp Thr Ser Asn Leu Asp Leu  
500 505 510

ctc acc ggg ctt cgg aaa ttc gca gat gat gaa aaa cta cat gct gag 1641  
Leu Thr Gly Leu Arg Lys Phe Ala Asp Asp Glu Lys Leu His Ala Glu  
515 520 525

tgg gca gca gcc aag ctg gcc agc aaa aag cgc cta gcc aag cat gta 1689

Trp Ala Ala Ala Lys Leu Ala Ser Lys Lys Arg Leu Ala Lys His Val  
530 535 540

ttg gat gtg act ggt gtt aca att gac cca gat agc ctt ttt gat ata 1737  
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545 550 555 560

caa att aaa cgc atc cac gaa tac aag aga cag ctg atg aac att ttg 1785  
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565 570 575

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580 585 590

agg cag aag gtt aca ccg cgc act gtc atg gta gga ggg aaa gca ttt 1881  
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595 600 605

gca aca tac acc aac gcc aaa aga ata gtg aaa ttg gta aat gat gtt 1929  
Ala Thr Tyr Thr Asn Ala Lys Arg Ile Val Lys Leu Val Asn Asp Val  
610 615 620

ggt gct gtg gtg aac aac gat gct gac gtc aac aaa tat ctg aag gtg 1977  
Gly Ala Val Val Asn Asp Ala Asp Val Asn Lys Tyr Leu Lys Val  
625 630 635 640

gtg ttc att cca aac tac aat gta tca gtg gct gaa gtg ctc att cct 2025  
Val Phe Ile Pro Asn Tyr Asn Val Ser Val Ala Glu Val Leu Ile Pro  
645 650 655

ggc agt gaa ctg tca cag cac atc agt act gca ggc atg gaa gca agt 2073  
Gly Ser Glu Leu Ser Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser  
660 665 670

gga aca agt aac atg aag ttc tct ctg aat ggc tgt gtt atc att gga 2121  
Gly Thr Ser Asn Met Lys Phe Ser Leu Asn Gly Cys Val Ile Ile Gly  
675 680 685

act ctc gat gga gcc aat gtt gaa atc aga gaa gaa gtg gga caa gac 2169  
Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu Glu Val Gly Gln Asp  
690 695 700

aac ttc ttc ctt ttc ggt gcc aaa gca gat cag gtt gct ggt ctg agg 2217  
Asn Phe Phe Leu Phe Gly Ala Lys Ala Asp Gln Val Ala Gly Leu Arg  
705 710 715 720

aag gat aga gaa aat ggc ttg ttc aag cca gac cca cgc ttc gaa gaa 2265  
Lys Asp Arg Glu Asn Gly Leu Phe Lys Pro Asp Pro Arg Phe Glu Glu  
725 730 735

gcc aag cag ttt atc agg agt ggt gct ttc ggc acc tac gac tac act 2313  
Ala Lys Gln Phe Ile Arg Ser Gly Ala Phe Gly Thr Tyr Asp Tyr Thr  
740 745 750

cct ctc ttg gat tcc ctt gaa ggg aac act gga ttt ggg cgt ggt gac 2361  
Pro Leu Leu Asp Ser Leu Glu Gly Asn Thr Gly Phe Gly Arg Gly Asp  
755 760 765

tac ttc ctt gtt ggc tat gac ttt cca agc tac att gat gca cag gcc 2409

Tyr Phe Leu Val Gly Tyr Asp Phe Pro Ser Tyr Ile Asp Ala Gln Ala  
770 775 780

cgg gtt gat gaa gcc tac aag gac aag aag aaa tgg gtc aag atg tcc 2457  
Arg Val Asp Glu Ala Tyr Lys Asp Lys Lys Lys Trp Val Lys Met Ser  
785 790 795 800

atc ttg aac acg gct gga agc ggc aag ttc agc agc gac cgc acc atc 2505  
Ile Leu Asn Thr Ala Gly Ser Gly Lys Phe Ser Ser Asp Arg Thr Ile  
805 810 815

gac caa tat gcg aag gag atc tgg ggc att tcg gct tgc cct gtt cca 2553  
Asp Gln Tyr Ala Lys Glu Ile Trp Gly Ile Ser Ala Cys Pro Val Pro  
820 825 830

tga agaggagacg tgatcaagag gtgatggatg atgatgcgtg gcagtaataa 2606

ggaccttata ctggtccatg gtgaataacc cctgcttccg ttgtagctga gaagaatgaa 2666

gcaacgtacg aagcctgttg tgttgtgtat tctgctgcac tttgaagtg catagaggat 2726

gcgacttttc tttgttctt tttctttttt ggtctgtaac catactattt tgatcctgaa 2786

ccggaatggc ggaatcatcc aggttctcaa taaaatagtt caagttttga ttaaaaaaaaa 2846

aaaaaaaaa 2856

<210> 20

<211> 832

<212> PRT

<213> Triticum aestivum

<400> 20

Met Ser Ala Ala Asp Lys Val Lys Pro Ala Ala Ser Pro Ala Ser Glu  
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Asp Pro Ser Ala Ile Ala Gly Asn Ile Ser Tyr His Ala Gln Tyr Ser  
20 25 30

Pro His Phe Ser Pro Leu Ala Phe Gly Pro Glu Gln Ala Phe Tyr Ala  
35 40 45

Thr Ala Glu Ser Val Arg Asp His Leu Leu Gln Arg Trp Asn Asp Thr  
50 55 60

Tyr Leu His Phe His Lys Thr Asp Pro Lys Gln Thr Tyr Tyr Leu Ser  
65 70 75 80

Met Glu Tyr Leu Gln Gly Arg Ala Leu Thr Asn Ala Val Gly Asn Leu  
85 90 95

Ala Ile Thr Gly Ala Tyr Ala Asp Ala Leu Lys Lys Phe Gly Tyr Glu

100	105	110
Leu Glu Ala Ile Ala Gly Gln Glu Arg Asp Ala Ala Leu Gly Asn Gly		
115	120	125
Gly Leu Gly Arg Leu Ala Ser Cys Phe Leu Asp Ser Met Ala Thr Leu		
130	135	140
Asn Leu Pro Ser Trp Gly Tyr Gly Leu Arg Tyr Arg Tyr Gly Leu Phe		
145	150	155
		160
Lys Gln Arg Ile Ala Lys Glu Gly Gln Glu Glu Ile Ala Glu Asp Trp		
165	170	175
Leu Asp Lys Phe Ser Pro Trp Glu Ile Val Arg His Asp Val Val Tyr		
180	185	190
Pro Ile Arg Phe Phe Gly His Val Glu Ile Ser Pro Asp Gly Lys Arg		
195	200	205
Lys Trp Ala Gly Gly Glu Val Leu Asn Ala Leu Ala Tyr Asp Val Pro		
210	215	220
Ile Pro Gly Tyr Lys Thr Lys Asn Ala Ile Ser Leu Arg Leu Trp Asp		
225	230	235
		240
Ala Thr Ala Thr Ala Glu Asp Phe Asn Leu Phe Gln Phe Asn Asp Gly		
245	250	255
Gln Tyr Glu Ser Ala Ala Gln Leu His Ser Arg Ala Gln Gln Ile Cys		
260	265	270
Ala Val Leu Tyr Pro Gly Asp Ala Thr Glu Glu Gly Lys Leu Leu Arg		
275	280	285
Leu Lys Gln Gln Tyr Phe Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile		
290	295	300
Phe Arg Phe Lys Glu Arg Lys Ala Asp Arg Val Ser Gly Lys Trp Ser		
305	310	315
		320
Glu Phe Pro Ser Lys Val Ala Val Gln Met Asn Asp Thr His Pro Thr		
325	330	335
Leu Ala Ile Pro Glu Leu Met Arg Leu Leu Met Asp Val Glu Gly Leu		

340	345	350
Gly Trp Asp Glu Ala Trp Ala Val Thr Asn Lys Thr Val Ala Tyr Thr		
355	360	365
Asn His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Gln Ala Val		
370	375	380
Met Lys Lys Leu Leu Pro Arg His Met Glu Ile Ile Glu Glu Ile Asp		
385	390	395 400
Lys Arg Phe Arg Glu Met Val Ile Ser Thr Arg Lys Asp Met Glu Gly		
405	410	415
Lys Ile Glu Ser Met Arg Val Leu Asp Asn Asn Pro Glu Lys Pro Val		
420	425	430
Val Arg Met Ala Asn Leu Cys Val Val Ala Gly His Thr Val Asn Gly		
435	440	445
Val Ala Glu Leu His Ser Asn Ile Leu Lys Gln Glu Leu Phe Ala Asp		
450	455	460
Tyr Val Ser Ile Trp Pro Asn Lys Phe Gln Asn Lys Thr Asn Gly Ile		
465	470	475 480
Thr Pro Arg Arg Trp Leu Arg Phe Cys Asn Pro Glu Leu Ser Glu Ile		
485	490	495
Val Thr Lys Trp Leu Lys Thr Asp Gln Trp Thr Ser Asn Leu Asp Leu		
500	505	510
Leu Thr Gly Leu Arg Lys Phe Ala Asp Asp Glu Lys Leu His Ala Glu		
515	520	525
Trp Ala Ala Ala Lys Leu Ala Ser Lys Lys Arg Leu Ala Lys His Val		
530	535	540
Leu Asp Val Thr Gly Val Thr Ile Asp Pro Asp Ser Leu Phe Asp Ile		
545	550	555 560
Gln Ile Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Met Asn Ile Leu		
565	570	575
Gly Ala Val Tyr Arg Tyr Lys Lys Leu Lys Glu Met Ser Ala Ala Asp		



580

585

590

Arg Gln Lys Val Thr Pro Arg Thr Val Met Val Gly Gly Lys Ala Phe  
595 600 605

Ala Thr Tyr Thr Asn Ala Lys Arg Ile Val Lys Leu Val Asn Asp Val  
610 615 620

Gly Ala Val Val Asn Asn Asp Ala Asp Val Asn Lys Tyr Leu Lys Val  
625 630 635 640

Val Phe Ile Pro Asn Tyr Asn Val Ser Val Ala Glu Val Leu Ile Pro  
645 650 655

Gly Ser Glu Leu Ser Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser  
660 665 670

Gly Thr Ser Asn Met Lys Phe Ser Leu Asn Gly Cys Val Ile Ile Gly  
675 680 685

Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu Glu Val Gly Gln Asp  
690 695 700

Asn Phe Phe Leu Phe Gly Ala Lys Ala Asp Gln Val Ala Gly Leu Arg  
705 710 715 720

Lys Asp Arg Glu Asn Gly Leu Phe Lys Pro Asp Pro Arg Phe Glu Glu  
725 730 735

Ala Lys Gln Phe Ile Arg Ser Gly Ala Phe Gly Thr Tyr Asp Tyr Thr  
740 745 750

Pro Leu Leu Asp Ser Leu Glu Gly Asn Thr Gly Phe Gly Arg Gly Asp  
755 760 765

Tyr Phe Leu Val Gly Tyr Asp Phe Pro Ser Tyr Ile Asp Ala Gln Ala  
770 775 780

Arg Val Asp Glu Ala Tyr Lys Asp Lys Lys Lys Trp Val Lys Met Ser  
785 790 795 800

Ile Leu Asn Thr Ala Gly Ser Gly Lys Phe Ser Ser Asp Arg Thr Ile  
805 810 815

Asp Gln Tyr Ala Lys Glu Ile Trp Gly Ile Ser Ala Cys Pro Val Pro

820

825

830

<210> 21  
 <211> 2884  
 <212> DNA  
 <213> Citrus hybrid cultivar

<220>  
 <221> CDS  
 <222> (48)..(2570)

<400> 21  
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 Met Ala Asp  
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gcg aaa gca aac gga aag aat gag gcg gcc aaa ctg gcg aaa att ccg 104  
 Ala Lys Ala Asn Gly Lys Asn Glu Ala Ala Lys Leu Ala Lys Ile Pro  
 5 10 15

gcg gct gcg aat cca ttg gct aat gaa cca tcg gcg att gca tca aat 152  
 Ala Ala Ala Asn Pro Leu Ala Asn Glu Pro Ser Ala Ile Ala Ser Asn  
 20 25 30 35

ata agt tac cac gtg cag tac agt cct cat ttc tcg ccg act aag ttc 200  
 Ile Ser Tyr His Val Gln Tyr Ser Pro His Phe Ser Pro Thr Lys Phe  
 40 45 50

gag ccg gag caa gct ttc ttt gcc acg gcg gag gtt gtc cgc gat cgt 248  
 Glu Pro Glu Gln Ala Phe Phe Ala Thr Ala Glu Val Val Arg Asp Arg  
 55 60 65

ctt att caa caa tgg aat gag aca tac cac cat ttt aat aaa gtt gat 296  
 Leu Ile Gln Gln Trp Asn Glu Thr Tyr His His Phe Asn Lys Val Asp  
 70 75 80

ccg aag caa aca tac tac cta tca atg gaa ttt ctt caa gga agg act 344  
 Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Phe Leu Gln Gly Arg Thr  
 85 90 95

ttg act aat gca att ggc agt ttg gac att cag aat gca tat gct gat 392  
 Leu Thr Asn Ala Ile Gly Ser Leu Asp Ile Gln Asn Ala Tyr Ala Asp  
 100 105 110 115

gct tta aat aat ttg ggg cat gtc ctt gag gag ata gct gaa cag gaa 440  
 Ala Leu Asn Asn Leu Gly His Val Leu Glu Glu Ile Ala Glu Gln Glu  
 120 125 130

aaa gat gct gca cta gga aat ggt ggg ctg ggc agg cta gct tca tgc 488  
 Lys Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser Cys  
 135 140 145

ttc tta gac tcc atg gca aca ttg aat ttg cct gca tgg ggt tat ggt 536  
 Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr Gly  
 150 155 160

ttg aga tac ccg tat ggg ctg ttc aag cag aag atc acc aag cag ggt 584  
 Leu Arg Tyr Arg Tyr Gly Leu Phe Lys Gln Lys Ile Thr Lys Gln Gly

165	170	175	
caa gaa gaa gtt gct gaa gat tgg ctt gag aaa ttt agt cct tgg gaa 632			
Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp Glu			
180	185	190	195
gtt gtc agg cat gat gtg gta ttt ccg gtc aga ttt ttt ggg agt gtt 680			
Val Val Arg His Asp Val Val Phe Pro Val Arg Phe Phe Gly Ser Val			
200	205	210	
atg gtt aat cca aat gga acg aga aaa tgg gtt ggg ggt gaa gtt gtc 728			
Met Val Asn Pro Asn Gly Thr Arg Lys Trp Val Gly Gly Glu Val Val			
215	220	225	
caa gcc gta gct tat gat ata cca att cca ggg tac aaa acc aag aac 776			
Gln Ala Val Ala Tyr Asp Ile Pro Ile Pro Gly Tyr Lys Thr Lys Asn			
230	235	240	
act atc agt ctt cgt ctc tgg gac gct aaa gct agc gct gag gat ttc 824			
Thr Ile Ser Leu Arg Leu Trp Asp Ala Lys Ala Ser Ala Glu Asp Phe			
245	250	255	
aat tta ttt cag ttt aat gat gga caa tac gaa tct gct gca cag ctt 872			
Asn Leu Phe Gln Phe Asn Asp Gly Gln Tyr Glu Ser Ala Ala Gln Leu			
260	265	270	275
cat tct cga gct caa cag att tgt gct gtg ctc tac ccc ggg gat tct 920			
His Ser Arg Ala Gln Gln Ile Cys Ala Val Leu Tyr Pro Gly Asp Ser			
280	285	290	
act gaa gaa ggg aag ctt tta agg ctg aaa caa caa ttc ttt ctc tgc 968			
Thr Glu Glu Gly Lys Leu Leu Arg Leu Lys Gln Gln Phe Phe Leu Cys			
295	300	305	
agt gct tca ctt cag gat atg att ctt aga ttc aag gag agg aaa agt 1016			
Ser Ala Ser Leu Gln Asp Met Ile Leu Arg Phe Lys Glu Arg Lys Ser			
310	315	320	
gga agg cag tgg tct gaa ttt ccc agc aag gta gct gta caa ctg aat 1064			
Gly Arg Gln Trp Ser Glu Phe Pro Ser Lys Val Ala Val Gln Leu Asn			
325	330	335	
gat act cat cca aca ctt gca att cca gag ttg atg cga ttg cta atg 1112			
Asp Thr His Pro Thr Leu Ala Ile Pro Glu Leu Met Arg Leu Leu Met			
340	345	350	355
gat gag gaa gga ctt gga tgg gat gaa gca tgg gat ata aca aca agg 1160			
Asp Glu Glu Gly Leu Gly Trp Asp Glu Ala Trp Asp Ile Thr Thr Arg			
360	365	370	
act gtt gct tat acc aat cac aca gta ctt cct gaa gca ctt gag aag 1208			
Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala Leu Glu Lys			
375	380	385	
tgg tca caa gca gta atg tgg aag ctt ctt cct cgc cat atg gaa ata 1256			
Trp Ser Gln Ala Val Met Trp Lys Leu Leu Pro Arg His Met Glu Ile			
390	395	400	
att gaa gag att gac aag aga ttc att gca atg gtc cgc tcc aca agg 1304			
Ile Glu Glu Ile Asp Lys Arg Phe Ile Ala Met Val Arg Ser Thr Arg			

405

410

415

agt gac ctt gag agt aag att ccc agc atg tgc atc ttg gat aat aat 1352  
 Ser Asp Leu Glu Ser Lys Ile Pro Ser Met Cys Ile Leu Asp Asn Asn  
 420 425 430 435

ccc aaa aag ccg gtt gtt agg atg gca aac tta tgt gta gta tct gcg 1400  
 Pro Lys Lys Pro Val Val Arg Met Ala Asn Leu Cys Val Val Ser Ala  
 440 445 450

cat acg gta aat ggt gtt gct cag ttg cac agt gat atc tta aag gcc 1448  
 His Thr Val Asn Gly Val Ala Gln Leu His Ser Asp Ile Leu Lys Ala  
 455 460 465

gac ttg ttc gct gac tat gtt tct cta tgg cca aac aaa ctc caa aat 1496  
 Asp Leu Phe Ala Asp Tyr Val Ser Leu Trp Pro Asn Lys Leu Gln Asn  
 470 475 480

aaa act aat ggc att act cct cgt cga tgg ctc cgg ttt tgc aat cct 1544  
 Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Leu Arg Phe Cys Asn Pro  
 485 490 495

gag ctc agc aaa att atc aca aaa tgg tta aaa acc gat cag tgg gtt 1592  
 Glu Leu Ser Lys Ile Ile Thr Lys Trp Leu Lys Thr Asp Gln Trp Val  
 500 505 510 515

acg aac ctt gac ctg ctt gta ggt ctt cgt cag ttt gct gac aac aca 1640  
 Thr Asn Leu Asp Leu Leu Val Gly Leu Arg Gln Phe Ala Asp Asn Thr  
 520 525 530

gaa ctc caa gct gaa tgg gaa tct gct aag atg gcc agt aag aaa cat 1688  
 Glu Leu Gln Ala Glu Trp Glu Ser Ala Lys Met Ala Ser Lys Lys His  
 535 540 545

ttg gca gac tac ata tgg cga gta acc ggt gta acg att gat cct aat 1736  
 Leu Ala Asp Tyr Ile Trp Arg Val Thr Gly Val Thr Ile Asp Pro Asn  
 550 555 560

agc tta ttt gac ata caa gtc aag cgc att cat gaa tac aag aga caa 1784  
 Ser Leu Phe Asp Ile Gln Val Lys Arg Ile His Glu Tyr Lys Arg Gln  
 565 570 575

ctg cta aat att ttg ggc gca atc tac aga tac aag aag ttg aag gag 1832  
 Leu Leu Asn Ile Leu Gly Ala Ile Tyr Arg Tyr Lys Lys Leu Lys Glu  
 580 585 590 595

atg agc cct cag gag cgg aag aaa act act cca cgc acc att atg ttt 1880  
 Met Ser Pro Gln Glu Arg Lys Lys Thr Thr Pro Arg Thr Ile Met Phe  
 600 605 610

gga ggg aaa gca ttt gca aca tat aca aac gca aaa aga ata gta aag 1928  
 Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys Arg Ile Val Lys  
 615 620 625

ttg gtt aat gat gtt ggt gaa gtc gtc aac acc gat cct gag gtc aat 1976  
 Leu Val Asn Asp Val Gly Glu Val Val Asn Thr Asp Pro Glu Val Asn  
 630 635 640

agt tat ttg aag gtg gta ttt gtt cca aat tac aat gtc tct gtt gcg 2024  
 Ser Tyr Leu Lys Val Val Phe Val Pro Asn Tyr Asn Val Ser Val Ala

645	650	655	
gag ttg ctt att cca gga agt gag cta tct cag cat att agc aca gca 2072			
Glu Leu Leu Ile Pro Gly Ser Glu Leu Ser Gln His Ile Ser Thr Ala			
660	665	670	675
ggc atg gag gca agt ggc aca agc aac atg aaa ttt tct cta aat ggt 2120			
Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ser Leu Asn Gly			
680	685	690	
tgc ctc att ata gga aca ttg gat gga gct aat gtg gaa atc agg cag 2168			
Cys Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Gln			
695	700	705	
gag ata gga gag gag aat ttc ttt ctc ttt ggt gca gga gca gac caa 2216			
Glu Ile Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Gly Ala Asp Gln			
710	715	720	
gtc cct aag ctg cgg aag gaa aga gaa gat gga ttg ttc aaa cca gat 2264			
Val Pro Lys Leu Arg Lys Glu Arg Glu Asp Gly Leu Phe Lys Pro Asp			
725	730	735	
cct cgg ttt gaa gag gcc aag caa ttt ata aga agt gga gca ttt gga 2312			
Pro Arg Phe Glu Glu Ala Lys Gln Phe Ile Arg Ser Gly Ala Phe Gly			
740	745	750	755
agc tat gac tac aac ccg ctt ctt gat tcc ctg gag ggg aac act ggt 2360			
Ser Tyr Asp Tyr Asn Pro Leu Leu Asp Ser Leu Glu Gly Asn Thr Gly			
760	765	770	
tat ggt cgt ggt gat tat ttt cta gtt ggt tat gac ttc cca agt tac 2408			
Tyr Gly Arg Gly Asp Tyr Phe Leu Val Gly Tyr Asp Phe Pro Ser Tyr			
775	780	785	
tta gag gct cag gac aga gtt gac caa gct tac aag gac cgg aag aag 2456			
Leu Glu Ala Gln Asp Arg Val Asp Gln Ala Tyr Lys Asp Arg Lys Lys			
790	795	800	
tgg ctg aag atg tct ata tta agt aca gct ggc agt ggg aaa ttc agc 2504			
Trp Leu Lys Met Ser Ile Leu Ser Thr Ala Gly Ser Gly Lys Phe Ser			
805	810	815	
agt gat cgc aca att gca cag tat gct aag gaa atc tgg aac ata aca 2552			
Ser Asp Arg Thr Ile Ala Gln Tyr Ala Lys Glu Ile Trp Asn Ile Thr			
820	825	830	835
gaa tgc cgt aca tca tga ttcaagtga aaaaaatttc atgtgcaata 2600			
Glu Cys Arg Thr Ser			
840			
ggttatataa tttcttgga ggaatgtatta agatgggaag aaaatgaaag gaaatccaca 2660			
atctgtgggg atcattaaat aaacctgtct ctccgtctta accatcattt gtttactcaa 2720			
acatcgctct gtcagataag ttttaagttg taatttctta aacaattcta tctttataag 2780			
aatttccagg ttttgaagaa ttacatcatt tgtcattact gataatagta cgaaggaatt 2840			
atgatacacc atttttttt tgttttaaaa aaaaaaaaaa aaaa 2884			

<210> 22  
<211> 840  
<212> PRT  
<213> Citrus hybrid cultivar

<400> 22

Met Ala Asp Ala Lys Ala Asn Gly Lys Asn Glu Ala Ala Lys Leu Ala  
1 5 10 15

Lys Ile Pro Ala Ala Ala Asn Pro Leu Ala Asn Glu Pro Ser Ala Ile  
20 25 30

Ala Ser Asn Ile Ser Tyr His Val Gln Tyr Ser Pro His Phe Ser Pro  
35 40 45

Thr Lys Phe Glu Pro Glu Gln Ala Phe Phe Ala Thr Ala Glu Val Val  
50 55 60

Arg Asp Arg Leu Ile Gln Gln Trp Asn Glu Thr Tyr His His Phe Asn  
65 70 75 80

Lys Val Asp Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Phe Leu Gln  
85 90 95

Gly Arg Thr Leu Thr Asn Ala Ile Gly Ser Leu Asp Ile Gln Asn Ala  
100 105 110

Tyr Ala Asp Ala Leu Asn Asn Leu Gly His Val Leu Glu Glu Ile Ala  
115 120 125

Glu Gln Glu Lys Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu  
130 135 140

Ala Ser Cys Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp  
145 150 155 160

Gly Tyr Gly Leu Arg Tyr Arg Tyr Gly Leu Phe Lys Gln Lys Ile Thr  
165 170 175

Lys Gln Gly Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Lys Phe Ser  
180 185 190

Pro Trp Glu Val Val Arg His Asp Val Val Phe Pro Val Arg Phe Phe  
195 200 205

Gly Ser Val Met Val Asn Pro Asn Gly Thr Arg Lys Trp Val Gly Gly  
210 215 220

Glu Val Val Gln Ala Val Ala Tyr Asp Ile Pro Ile Pro Gly Tyr Lys  
225 230 235 240

Thr Lys Asn Thr Ile Ser Leu Arg Leu Trp Asp Ala Lys Ala Ser Ala  
245 250 255

Glu Asp Phe Asn Leu Phe Gln Phe Asn Asp Gly Gln Tyr Glu Ser Ala  
260 265 270

Ala Gln Leu His Ser Arg Ala Gln Gln Ile Cys Ala Val Leu Tyr Pro  
275 280 285

Gly Asp Ser Thr Glu Glu Gly Lys Leu Leu Arg Leu Lys Gln Gln Phe  
290 295 300

Phe Leu Cys Ser Ala Ser Leu Gln Asp Met Ile Leu Arg Phe Lys Glu  
305 310 315 320

Arg Lys Ser Gly Arg Gln Trp Ser Glu Phe Pro Ser Lys Val Ala Val  
325 330 335

Gln Leu Asn Asp Thr His Pro Thr Leu Ala Ile Pro Glu Leu Met Arg  
340 345 350

Leu Leu Met Asp Glu Glu Gly Leu Gly Trp Asp Glu Ala Trp Asp Ile  
355 360 365

Thr Thr Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala  
370 375 380

Leu Glu Lys Trp Ser Gln Ala Val Met Trp Lys Leu Leu Pro Arg His  
385 390 395 400

Met Glu Ile Ile Glu Glu Ile Asp Lys Arg Phe Ile Ala Met Val Arg  
405 410 415

Ser Thr Arg Ser Asp Leu Glu Ser Lys Ile Pro Ser Met Cys Ile Leu  
420 425 430

Asp Asn Asn Pro Lys Lys Pro Val Val Arg Met Ala Asn Leu Cys Val  
435 440 445

Val Ser Ala His Thr Val Asn Gly Val Ala Gln Leu His Ser Asp Ile  
450 455 460

Leu Lys Ala Asp Leu Phe Ala Asp Tyr Val Ser Leu Trp Pro Asn Lys  
465 470 475 480

Leu Gln Asn Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Leu Arg Phe  
485 490 495

Cys Asn Pro Glu Leu Ser Lys Ile Ile Thr Lys Trp Leu Lys Thr Asp  
500 505 510

Gln Trp Val Thr Asn Leu Asp Leu Leu Val Gly Leu Arg Gln Phe Ala  
515 520 525

Asp Asn Thr Glu Leu Gln Ala Glu Trp Glu Ser Ala Lys Met Ala Ser  
530 535 540

Lys Lys His Leu Ala Asp Tyr Ile Trp Arg Val Thr Gly Val Thr Ile  
545 550 555 560

Asp Pro Asn Ser Leu Phe Asp Ile Gln Val Lys Arg Ile His Glu Tyr  
565 570 575

Lys Arg Gln Leu Leu Asn Ile Leu Gly Ala Ile Tyr Arg Tyr Lys Lys  
580 585 590

Leu Lys Glu Met Ser Pro Gln Glu Arg Lys Lys Thr Thr Pro Arg Thr  
595 600 605

Ile Met Phe Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys Arg  
610 615 620

Ile Val Lys Leu Val Asn Asp Val Gly Glu Val Val Asn Thr Asp Pro  
625 630 635 640

Glu Val Asn Ser Tyr Leu Lys Val Val Phe Val Pro Asn Tyr Asn Val  
645 650 655

Ser Val Ala Glu Leu Leu Ile Pro Gly Ser Glu Leu Ser Gln His Ile  
660 665 670

Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ser  
675 680 685



Leu Asn Gly Cys Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn Val Glu  
690 695 700

Ile Arg Gln Glu Ile Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Gly  
705 710 715 720

Ala Asp Gln Val Pro Lys Leu Arg Lys Glu Arg Glu Asp Gly Leu Phe  
725 730 735

Lys Pro Asp Pro Arg Phe Glu Glu Ala Lys Gln Phe Ile Arg Ser Gly  
740 745 750

Ala Phe Gly Ser Tyr Asp Tyr Asn Pro Leu Leu Asp Ser Leu Glu Gly  
755 760 765

Asn Thr Gly Tyr Gly Arg Gly Asp Tyr Phe Leu Val Gly Tyr Asp Phe  
770 775 780

Pro Ser Tyr Leu Glu Ala Gln Asp Arg Val Asp Gln Ala Tyr Lys Asp  
785 790 795 800

Arg Lys Lys Trp Leu Lys Met Ser Ile Leu Ser Thr Ala Gly Ser Gly  
805 810 815

Lys Phe Ser Ser Asp Arg Thr Ile Ala Gln Tyr Ala Lys Glu Ile Trp  
820 825 830

Asn Ile Thr Glu Cys Arg Thr Ser  
835 840

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<211> 2526  
<212> DNA  
<213> Oryza sativa

<220>  
<221> CDS  
<222> (1)..(2526)

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Met Pro Glu Ser Asn Gly Ala Ala Cys Gly Ala Ala Glu Lys Val Lys  
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ccg gcg gcc agc ccc gcg tgc gag gag ccg gcc gcc atc gcc ggt aac 96  
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Ile Ser Phe His Ala Gln Tyr Ser Pro His Phe Ser Pro Leu Ala Phe  
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ggc ccc gag cag gcc ttc tac tcc acc gcc gag agc gtc cgc gat cac 192  
Gly Pro Glu Gln Ala Phe Tyr Ser Thr Ala Glu Ser Val Arg Asp His  
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ctc gtc cag aga tgg aac gag acg tac ttg cat ttc cac aag acg gat 240  
Leu Val Gln Arg Trp Asn Glu Thr Tyr Leu His Phe His Lys Thr Asp  
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Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Tyr Leu Gln Gly Arg Ala  
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ctc acc aac gcc gtc ggc aac ctc ggc atc acc ggc gcc tac gcg gag 336  
Leu Thr Asn Ala Val Gly Asn Leu Gly Ile Thr Gly Ala Tyr Ala Glu  
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Ala Val Lys Lys Phe Gly Tyr Glu Leu Glu Ala Leu Val Gly Gln Glu  
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Gln Glu Glu Ile Ala Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp Glu  
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225 230 235 240

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aac tta ttt caa ttc aat gat ggc cag tat gag tcc gct gct caa ctt 816  
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cat gct agg gca caa cag ata tgt gcc gtt ctc tat ccc ggt gat gct 864

His Ala Arg Ala Gln Gln Ile Cys Ala Val Leu Tyr Pro Gly Asp Ala  
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Thr Glu Glu Gly Lys Leu Leu Arg Leu Lys Gln Gln Tyr Phe Leu Cys  
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agt gca tcg ctt cag gat att ttt ttc agg ttt aaa gaa agg aaa gct 960  
Ser Ala Ser Leu Gln Asp Ile Phe Phe Arg Phe Lys Glu Arg Lys Ala  
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Asp Gln Trp Thr Ser Asn Leu Asp Leu Leu Thr Gly Leu Arg Lys Phe  
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Ser Lys Lys Arg Leu Ala Lys His Val Leu Asp Val Thr Gly Val Thr  
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Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly Ala Val Tyr Arg Tyr Lys  
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Lys Leu Lys Gly Met Ser Ala Glu Glu Arg Gln Lys Val Thr Pro Arg  
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Thr Val Met Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys  
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690 695 700

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785 790 795 800

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Gly Pro Glu Gln Ala Phe Tyr Ser Thr Ala Glu Ser Val Arg Asp His  
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Leu Val Gln Arg Trp Asn Glu Thr Tyr Leu His Phe His Lys Thr Asp  
65 70 75 80

Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Tyr Leu Gln Gly Arg Ala  
85 90 95

Leu Thr Asn Ala Val Gly Asn Leu Gly Ile Thr Gly Ala Tyr Ala Glu  
100 105 110

Ala Val Lys Lys Phe Gly Tyr Glu Leu Glu Ala Leu Val Gly Gln Glu

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Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr Gly		
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Leu Arg Tyr Arg Tyr Gly Leu Phe Lys Gln Cys Ile Thr Lys Glu Gly		
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Gln Glu Glu Ile Ala Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp Glu		
180	185	190
Ile Val Arg His Asp Ile Val Tyr Pro Ile Arg Phe Phe Gly His Val		
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Glu Ile Leu Pro Asp Gly Ser Arg Lys Trp Val Gly Gly Glu Val Leu		
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Asn Ala Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr Lys Thr Lys Asn		
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Ala Ile Ser Leu Arg Leu Trp Asp Ala Lys Ala Ser Ala Glu Asp Phe		
245	250	255
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Thr Glu Glu Gly Lys Leu Leu Arg Leu Lys Gln Gln Tyr Phe Leu Cys		
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Ser Ala Ser Leu Gln Asp Ile Phe Phe Arg Phe Lys Glu Arg Lys Ala		
305	310	315 320
Asp Arg Val Ser Gly Lys Trp Ser Glu Phe Pro Ala Lys Val Ala Val		
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Gln Leu Asn Asp Thr His Pro Thr Leu Ala Ile Pro Glu Leu Met Arg		
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Leu Glu Lys Trp Ser Gln Ile Val Met Arg Lys Leu Leu Pro Arg His  
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Met Glu Ile Ile Glu Glu Ile Asp Lys Arg Phe Lys Glu Met Val Ile  
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Ser Thr Arg Lys Glu Met Glu Gly Lys Ile Asp Ser Met Arg Ile Leu  
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Asp Asn Ser Asn Pro Gln Lys Pro Val Val Arg Met Ala Asn Leu Cys  
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Val Val Ser Ala His Thr Val Asn Gly Val Ala Glu Leu His Ser Asn  
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Ile Leu Lys Glu Glu Leu Phe Ala Asp Tyr Leu Ser Ile Trp Pro Asn  
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Lys Phe Gln Asn Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Leu Arg  
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Phe Cys Asn Pro Glu Leu Ser Glu Ile Val Thr Lys Trp Leu Lys Thr  
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Asp Gln Trp Thr Ser Asn Leu Asp Leu Leu Thr Gly Leu Arg Lys Phe  
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Ala Asp Asp Glu Lys Leu His Ala Glu Trp Ala Ser Ala Lys Leu Ala  
530                      535                      540

Ser Lys Lys Arg Leu Ala Lys His Val Leu Asp Val Thr Gly Val Thr  
545                      550                      555                      560

Ile Asp Pro Asn Ser Leu Phe Asp Ile Gln Ile Lys Arg Ile His Glu  
565                      570                      575

Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly Ala Val Tyr Arg Tyr Lys  
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Lys Leu Lys Gly Met Ser Ala Glu Glu Arg Gln Lys Val Thr Pro Arg

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600

605

Thr Val Met Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys  
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Arg Ile Val Lys Leu Val Asn Asp Val Gly Ala Val Val Asn Asn Asp  
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Pro Asp Val Asn Lys Tyr Leu Lys Val Val Phe Ile Pro Asn Tyr Asn  
645 650 655

Val Ser Val Ala Glu Val Leu Ile Pro Gly Ser Glu Leu Ser Gln His  
660 665 670

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675 680 685

Ser Leu Asn Gly Cys Val Ile Ile Gly Thr Leu Asp Gly Ala Asn Val  
690 695 700

Glu Ile Arg Glu Glu Val Gly Gln Glu Asn Phe Phe Leu Phe Gly Ala  
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Lys Ala Asp Gln Val Ala Gly Leu Arg Lys Asp Arg Glu Asn Gly Leu  
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740 745 750

Gly Ala Phe Gly Thr Tyr Asp Tyr Ala Pro Leu Leu Asp Ser Leu Glu  
755 760 765

Gly Asn Ser Gly Phe Gly Arg Gly Asp Tyr Phe Leu Val Gly Tyr Asp  
770 775 780

Phe Pro Ser Tyr Ile Asp Ala Gln Ala Gln Val Asp Glu Ala Tyr Lys  
785 790 795 800

Asp Lys Lys Lys Trp Ile Lys Met Ser Ile Leu Asn Thr Ala Gly Ser  
805 810 815

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820 825 830

Trp Gly Ile Thr Ala Ser Pro Val Ser



835

840

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 gctacctttc ttactctca taaggatttg aaaa atg ggt ttt aaa gta gaa act 175  
 Met Gly Phe Lys Val Glu Thr  
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 Asn Pro Leu Ala Glu Lys Pro Asp Glu Ile Ala Ser Asn Ile Ser Tyr  
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 cat gct cag tat act cct cat ttt tca cct ttc aaa ttt cag ctt caa 319  
 His Ala Gln Tyr Thr Pro His Phe Ser Pro Phe Lys Phe Gln Leu Gln  
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 Gln Ala Tyr Tyr Ala Thr Ala Glu Ser Val Arg Asp Arg Leu Ile Gln  
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 Gln Trp Asn Glu Thr Tyr Leu His Phe His Lys Val Asp Pro Lys Gln  
 75 80 85  
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 Ala Ile Gly Asn Leu Asn Ile Gln Asp Ala Tyr Ala Asp Ala Leu Arg  
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 Lys Phe Gly Leu Glu Leu Glu Ile Thr Glu Gln Glu Lys Asp Ala  
 120 125 130 135  
 gca cta gga aat ggt ggt ctt ggt agg ctt gct tct tgc ttt ctg gat 607  
 Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser Cys Phe Leu Asp  
 140 145 150  
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 Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr Gly Leu Arg Tyr

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Arg Tyr Gly Leu Phe Lys Gln Ile Ile Thr Lys Glu Gly Gln Glu Glu			
170	175	180	
ggt gct gag gac tgg ctt gag aag ttt agc cct tgg gaa att gtg agg			751
Val Ala Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp Glu Ile Val Arg			
185	190	195	
cat gac gtt ttg tac ccg atc aga ttc ttt ggc cag gtt gag gtt aac			799
His Asp Val Leu Tyr Pro Ile Arg Phe Phe Gly Gln Val Glu Val Asn			
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cct gat gga agc cga caa tgg ata ggc gga gaa gtt att caa gca cta			847
Pro Asp Gly Ser Arg Gln Trp Ile Gly Gly Glu Val Ile Gln Ala Leu			
220	225	230	
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Ala Tyr Asp Val Pro Ile Pro Gly Tyr Gln Thr Lys Asn Thr Ile Ser			
235	240	245	
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Leu Arg Leu Trp Glu Ala Lys Ala Cys Ala Asp Asp Phe Asp Leu Phe			
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Asn Trp Ser Glu Phe Pro Thr Lys Val Ala Val Gln Leu Asn Asp Thr			
330	335	340	
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His Pro Thr Leu Ser Ile Pro Glu Leu Met Arg Leu Leu Met Asp Asp			
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Glu Gly Leu Gly Trp Asp Glu Ala Trp Ala Val Thr Ser Lys Thr Val			
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gct tac act aat cac act gtc ctc cct gaa gcg ctg gag aaa tgg tct			1327
Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser			
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Gln Pro Val Met Trp Lys Leu Leu Pro Arg His Met Glu Ile Ile Glu			

395	400	405	
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425	430	435	
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490	495	500	
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caa gca gag tgg ctg tct gca aag agg gct aat aag cag cgc tta gca 1807			
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665	670	675	
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Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Leu Asn Arg Val Leu			
680	685	690	695
ata ata ggt aca tta gat gga gct aat gtc gaa atc cgg gag gag att	2287		
Ile Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu Glu Ile			
700	705	710	
ggt gag gag aat ttt ttc ctg ttt ggt gca aca gcg gat gaa gtc cct	2335		
Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Thr Ala Asp Glu Val Pro			
715	720	725	
cga ctc agg aag gaa aga gag aat gga ctg ttc aag ccg gat cct cga	2383		
Arg Leu Arg Lys Glu Arg Glu Asn Gly Leu Phe Lys Pro Asp Pro Arg			
730	735	740	
ttc gaa gag gca aag aag ttt ata agg agt ggg gtg ttt gga agc tac	2431		
Phe Glu Glu Ala Lys Lys Phe Ile Arg Ser Gly Val Phe Gly Ser Tyr			
745	750	755	
gac tac aac cca ttg ctc gat tca ttg gaa gga aat tct ggt tat ggt	2479		
Asp Tyr Asn Pro Leu Leu Asp Ser Leu Glu Gly Asn Ser Gly Tyr Gly			
760	765	770	775
cgc gga gat tac ttt ctt gtt ggt tat gac ttc cca agc tac atg gat	2527		
Arg Gly Asp Tyr Phe Leu Val Gly Tyr Asp Phe Pro Ser Tyr Met Asp			
780	785	790	
gct cag gaa aaa gta gac gaa gca tat cgt gat aag aaa agg tgg cta	2575		
Ala Gln Glu Lys Val Asp Glu Ala Tyr Arg Asp Lys Lys Arg Trp Leu			
795	800	805	
aaa atg tct att tta agc act gct ggg agt ggg aag ttc agc agt gac	2623		
Lys Met Ser Ile Leu Ser Thr Ala Gly Ser Gly Lys Phe Ser Ser Asp			
810	815	820	
agg aca att gct cag tat gct aag gaa att tgg aac atc gaa gaa tgc	2671		
Arg Thr Ile Ala Gln Tyr Ala Lys Glu Ile Trp Asn Ile Glu Glu Cys			
825	830	835	
cgg gta cca taa tttcaaggct ctgtatagta ctagagcatt gaaattaatg	2723		
Arg Val Pro			
840			
acagtatata gtcatgaata aaaaagaaca taattttcta tatttgattt tagtatgcca	2783		
tatcagggtt caactgtatt attattatag taagtgtcgt ttctctcgat gcatctgctt	2843		
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atcttcc

2910

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35 40 45

Pro Phe Lys Phe Gln Leu Gln Gln Ala Tyr Tyr Ala Thr Ala Glu Ser  
50 55 60

Val Arg Asp Arg Leu Ile Gln Gln Trp Asn Glu Thr Tyr Leu His Phe  
65 70 75 80

His Lys Val Asp Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Phe Leu  
85 90 95

Gln Gly Arg Ala Leu Thr Asn Ala Ile Gly Asn Leu Asn Ile Gln Asp  
100 105 110

Ala Tyr Ala Asp Ala Leu Arg Lys Phe Gly Leu Glu Leu Glu Glu Ile  
115 120 125

Thr Glu Gln Glu Lys Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg  
130 135 140

Leu Ala Ser Cys Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala  
145 150 155 160

Trp Gly Tyr Gly Leu Arg Tyr Arg Tyr Gly Leu Phe Lys Gln Ile Ile  
165 170 175

Thr Lys Glu Gly Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Lys Phe  
180 185 190

Ser Pro Trp Glu Ile Val Arg His Asp Val Leu Tyr Pro Ile Arg Phe  
195 200 205

Phe Gly Gln Val Glu Val Asn Pro Asp Gly Ser Arg Gln Trp Ile Gly  
210 215 220

Gly Glu Val Ile Gln Ala Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr  
225 230 235 240

Gln Thr Lys Asn Thr Ile Ser Leu Arg Leu Trp Glu Ala Lys Ala Cys  
245 250 255

Ala Asp Asp Phe Asp Leu Phe Leu Phe Asn Asp Gly Gln Leu Glu Ser  
260 265 270

Ala Ser Val Leu His Ser Arg Ala Gln Gln Ile Cys Ser Val Leu Tyr  
275 280 285

Pro Gly Asp Ala Thr Glu Gly Gly Lys Leu Leu Arg Leu Lys Gln Gln  
290 295 300

Tyr Phe Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Ser Arg Phe Lys  
305 310 315 320

Glu Arg Arg Gln Gly Pro Trp Asn Trp Ser Glu Phe Pro Thr Lys Val  
325 330 335

Ala Val Gln Leu Asn Asp Thr His Pro Thr Leu Ser Ile Pro Glu Leu  
340 345 350

Met Arg Leu Leu Met Asp Asp Glu Gly Leu Gly Trp Asp Glu Ala Trp  
355 360 365

Ala Val Thr Ser Lys Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro  
370 375 380

Glu Ala Leu Glu Lys Trp Ser Gln Pro Val Met Trp Lys Leu Leu Pro  
385 390 395 400

Arg His Met Glu Ile Ile Glu Glu Ile Asp Arg Arg Phe Val Ala Leu  
405 410 415

Ile Ser Lys Thr Arg Leu Asp Leu Glu Asp Glu Val Ser Asn Met Arg  
420 425 430

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435 440 445

Cys Val Val Ser Ser His Thr Val Asn Gly Val Ala Gln Leu His Ser  
450 455 460

Asp Ile Leu Lys Ser Glu Leu Phe Ala Ser Tyr Val Ser Ile Trp Pro  
465 470 475 480

Thr Lys Phe Gln Asn Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Ile  
485 490 495

Asn Phe Cys Ser Pro Glu Leu Ser Arg Ile Ile Thr Lys Trp Leu Lys  
500 505 510

Thr Asp Lys Trp Val Thr Asn Leu Asp Leu Leu Thr Gly Leu Arg Glu  
515 520 525

Phe Ala Asp Asn Glu Asp Leu Gln Ala Glu Trp Leu Ser Ala Lys Arg  
530 535 540

Ala Asn Lys Gln Arg Leu Ala Gln Tyr Val Leu Gln Val Thr Gly Glu  
545 550 555 560

Asn Ile Asp Pro Asp Ser Leu Phe Asp Ile Gln Val Lys Arg Ile His  
565 570 575

Glu Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly Val Ile Tyr Arg Tyr  
580 585 590

Lys Lys Leu Lys Glu Met Ser Pro Glu Glu Arg Lys Ser Thr Thr Ala  
595 600 605

Arg Thr Val Met Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala  
610 615 620

Lys Arg Ile Val Lys Leu Val Asp Asp Val Gly Ser Val Val Asn Ser  
625 630 635 640

Asp Pro Glu Val Asn Ser Tyr Leu Lys Val Val Phe Val Pro Asn Tyr  
645 650 655

Asn Val Ser Val Ala Glu Val Leu Ile Pro Gly Ser Glu Leu Ser Gln  
660 665 670

His Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys  
675 680 685

Phe Ala Leu Asn Arg Val Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn  
690 695 700

Val Glu Ile Arg Glu Glu Ile Gly Glu Glu Asn Phe Phe Leu Phe Gly  
705 710 715 720

Ala Thr Ala Asp Glu Val Pro Arg Leu Arg Lys Glu Arg Glu Asn Gly  
725 730 735

Leu Phe Lys Pro Asp Pro Arg Phe Glu Glu Ala Lys Lys Phe Ile Arg  
740 745 750

Ser Gly Val Phe Gly Ser Tyr Asp Tyr Asn Pro Leu Leu Asp Ser Leu  
755 760 765

Glu Gly Asn Ser Gly Tyr Gly Arg Gly Asp Tyr Phe Leu Val Gly Tyr  
770 775 780

Asp Phe Pro Ser Tyr Met Asp Ala Gln Glu Lys Val Asp Glu Ala Tyr  
785 790 795 800

Arg Asp Lys Lys Arg Trp Leu Lys Met Ser Ile Leu Ser Thr Ala Gly  
805 810 815

Ser Gly Lys Phe Ser Ser Asp Arg Thr Ile Ala Gln Tyr Ala Lys Glu  
820 825 830

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tcg gct aag gcg aat ccg gag gcc gat gat gct acg gag atc gct ggg 96  
Ser Ala Lys Ala Asn Pro Glu Ala Asp Ala Thr Glu Ile Ala Gly  
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aat atc gtc tac cac gcc aag tac agt cca cat ttc tct cca ttg aag 144  
 Asn Ile Val Tyr His Ala Lys Tyr Ser Pro His Phe Ser Pro Leu Lys  
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ttc ggg cct gag caa gct ctc tac gct acc gca gag agt ctt cgc gat 192  
 Phe Gly Pro Glu Gln Ala Leu Tyr Ala Thr Ala Glu Ser Leu Arg Asp  
     50                    55                    60

cgt ctc att cag ctg tgg aat gag act tat gtt cat ttt aac aaa gtt 240  
 Arg Leu Ile Gln Leu Trp Asn Glu Thr Tyr Val His Phe Asn Lys Val  
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gat cca aaa caa act tat tac ttg tca atg gag tat ctc caa ggt cgt 288  
 Asp Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Tyr Leu Gln Gly Arg  
             85                    90                    95

gct ttg acc aat gcc att ggg aat ttg aac ctt caa ggt cca tat gct 336  
 Ala Leu Thr Asn Ala Ile Gly Asn Leu Asn Leu Gln Gly Pro Tyr Ala  
             100                    105                    110

gat gca ctg cgt acg ctg ggt tat gag ctt gag gag ata gct gag cag 384  
 Asp Ala Leu Arg Thr Leu Gly Tyr Glu Leu Glu Glu Ile Ala Glu Gln  
             115                    120                    125

gag aaa gat gca gct cta gga aat ggt ggg tta ggg aga ctt gcc tcg 432  
 Glu Lys Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser  
             130                    135                    140

tgt ttc ttg gat tcg atg gcc acc cta aat ctg cct gct tgg ggt tat 480  
 Cys Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr  
     145                    150                    155                    160

ggt ttg agg tac aga cat ggg ttg ttt aag caa ata atc aca aag aaa 528  
 Gly Leu Arg Tyr Arg His Gly Leu Phe Lys Gln Ile Ile Thr Lys Lys  
             165                    170                    175

ggt caa gaa gag att cca gag gac tgg ctt gag aaa ttc agc cca tgg 576  
 Gly Gln Glu Glu Ile Pro Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp  
             180                    185                    190

gaa att gtg agg cac gac gtg gta ttc cct gtc aga ttt ttc ggc aag 624  
 Glu Ile Val Arg His Asp Val Val Phe Pro Val Arg Phe Phe Gly Lys  
             195                    200                    205

gtg caa gta aat ccg gat gga tca agg aaa tgg gta gat ggt gat gtt 672  
 Val Gln Val Asn Pro Asp Gly Ser Arg Lys Trp Val Asp Gly Asp Val  
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gta caa gct ctt gct tat gac gtg cca atc ccg gga tat ggc aca aag 720  
 Val Gln Ala Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr Gly Thr Lys  
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aac aca atc agt ctc cgt ctc tgg gaa gca aaa gct aga gct gag gat 768  
 Asn Thr Ile Ser Leu Arg Leu Trp Glu Ala Lys Ala Arg Ala Glu Asp  
             245                    250                    255

ctt gat ctt ttt cag ttc aac gaa gga gaa tat gaa ttg gct gca cag 816  
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             260                    265                    270

ctt cat tct cga gct caa cag att tgc act gtt tta tat cca gga gat 864  
 Leu His Ser Arg Ala Gln Gln Ile Cys Thr Val Leu Tyr Pro Gly Asp  
 275 280 285

gct acc gag aat ggg aag tta tta cgg tta aaa cag cag ttc ttt ctc 912  
 Ala Thr Glu Asn Gly Lys Leu Leu Arg Leu Lys Gln Gln Phe Phe Leu  
 290 295 300

tgc agt gct tcg ctt cag gat att ata tca aga ttt cac gag agg agc 960  
 Cys Ser Ala Ser Leu Gln Asp Ile Ile Ser Arg Phe His Glu Arg Ser  
 305 310 315 320

acc act gaa ggc agc cgg aaa tgg tca gag ttt cca agt aaa gtt gct 1008  
 Thr Thr Glu Gly Ser Arg Lys Trp Ser Glu Phe Pro Ser Lys Val Ala  
 325 330 335

gtt caa atg aat gac aca cac cca act ctt gca ata cct gag ctc atg 1056  
 Val Gln Met Asn Asp Thr His Pro Thr Leu Ala Ile Pro Glu Leu Met  
 340 345 350

cga ttg cta atg gat gac aat gga ctt gga tgg gat gag gct tgg gat 1104  
 Arg Leu Leu Met Asp Asp Asn Gly Leu Gly Trp Asp Glu Ala Trp Asp  
 355 360 365

gtg aca tca aag acc gtt gct tac acc aat cac act gtc ctt cct gaa 1152  
 Val Thr Ser Lys Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu  
 370 375 380

gcg ttg gag aaa tgg tca caa tct ttg atg tgg aag ctt ctt cct cgt 1200  
 Ala Leu Glu Lys Trp Ser Gln Ser Leu Met Trp Lys Leu Leu Pro Arg  
 385 390 395 400

cat atg gaa ata ata gaa gag att gac aag agg ttt gtt caa acc att 1248  
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 405 410 415

cgc gat aca aga gtt gat ctg gag gat aag att tca agt ttg agc atc 1296  
 Arg Asp Thr Arg Val Asp Leu Glu Asp Lys Ile Ser Ser Leu Ser Ile  
 420 425 430

tta gat aac aat cca caa aag cct gtg gtg aga atg gct aac tta tgt 1344  
 Leu Asp Asn Asn Pro Gln Lys Pro Val Val Arg Met Ala Asn Leu Cys  
 435 440 445

gtt gta tcc tcg cat acg gtg aat ggc gtt gct cag tta cac agt gat 1392  
 Val Val Ser Ser His Thr Val Asn Gly Val Ala Gln Leu His Ser Asp  
 450 455 460

atc ttg aag gct gag tta ttc gca gac tat gtc tct ata tgg cca aac 1440  
 Ile Leu Lys Ala Glu Leu Phe Ala Asp Tyr Val Ser Ile Trp Pro Asn  
 465 470 475 480

aag ttt caa aac aag act aat ggc atc aca cct cga agg tgg tta cgt 1488  
 Lys Phe Gln Asn Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Leu Arg  
 485 490 495

ttc tgc agc cct gag ctc agt gat ata atc aca aag tgg tta aag act 1536  
 Phe Cys Ser Pro Glu Leu Ser Asp Ile Ile Thr Lys Trp Leu Lys Thr  
 500 505 510

gac aaa tgg att acc gat ctt gac cta ctt acc ggt ctt cgc cag ttt 1584  
Asp Lys Trp Ile Thr Asp Leu Asp Leu Thr Gly Leu Arg Gln Phe  
515 520 525

gcg gac aat gaa gaa ctc caa tct gaa tgg gct tct gca aag aca gcc 1632  
Ala Asp Asn Glu Glu Leu Gln Ser Glu Trp Ala Ser Ala Lys Thr Ala  
530 535 540

aat aag aaa cgt ttg gct caa tat ata gag cgt gtg act ggt gtg agt 1680  
Asn Lys Lys Arg Leu Ala Gln Tyr Ile Glu Arg Val Thr Gly Val Ser  
545 550 555 560

atc gat cca aca agc tta ttt gac ata caa gtt aag cgt atc cac gaa 1728  
Ile Asp Pro Thr Ser Leu Phe Asp Ile Gln Val Lys Arg Ile His Glu  
565 570 575

tac aag agg cag ctg atg aac att ctt gga gta gta tac aga ttc aag 1776  
Tyr Lys Arg Gln Leu Met Asn Ile Leu Gly Val Val Tyr Arg Phe Lys  
580 585 590

aaa cta aag gag atg aag cct gag gag agg aag aaa aca gtt cct cgt 1824  
Lys Leu Lys Glu Met Lys Pro Glu Glu Arg Lys Lys Thr Val Pro Arg  
595 600 605

act gtc atg att ggg ggt aaa gca ttt gcc acc tat aca aat gca aaa 1872  
Thr Val Met Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys  
610 615 620

cgg ata gtg aag ctg gtg aat gat gtt ggt gat gtt gtt aac agc gat 1920  
Arg Ile Val Lys Leu Val Asn Asp Val Gly Asp Val Val Asn Ser Asp  
625 630 635 640

cca gag gtc aac gaa tac cta aag gtg gta ttt gtt cca aac tac aat 1968  
Pro Glu Val Asn Glu Tyr Leu Lys Val Val Phe Val Pro Asn Tyr Asn  
645 650 655

gtc act gta gcg gag atg cta ata ccc gga agt gag cta tct caa cac 2016  
Val Thr Val Ala Glu Met Leu Ile Ile Gly Ser Glu Leu Ser Gln His  
660 665 670

atc agc aca gca ggc atg gag gca agt ggt acc agc aat atg aaa ttc 2064  
Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe  
675 680 685

gct ctc aac ggt tgt ctt att ata gga acc ctt gat ggg gct aat gtt 2112  
Ala Leu Asn Gly Cys Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn Val  
690 695 700

gag ata aga gag gag gtt ggc gaa gaa aat ttc ttt ctt ttt ggt gca 2160  
Glu Ile Arg Glu Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala  
705 710 715 720

acg gcc gat cag gtc cct cga ctg cgt aaa gaa cga gaa gac gga ctg 2208  
Thr Ala Asp Gln Val Pro Arg Leu Arg Lys Glu Arg Glu Asp Gly Leu  
725 730 735

ttc aaa ccc gat cct cgg ttc gaa gag gca aag cag ttt gtc aaa agt 2256  
Phe Lys Pro Asp Pro Arg Phe Glu Glu Ala Lys Gln Phe Val Lys Ser  
740 745 750

gga gtg ttt ggg agc tac gat tat ggt cca ctc ctt gat tct ctt gag 2304  
Gly Val Phe Gly Ser Tyr Asp Tyr Gly Pro Leu Leu Asp Ser Leu Glu  
755 760 765

ggt aac aca ggt ttt gga cgt ggt gat tac ttc ctg gtt ggg tat gac 2352  
Gly Asn Thr Gly Phe Gly Arg Gly Asp Tyr Phe Leu Val Gly Tyr Asp  
770 775 780

ttc ccc agc tac atg gac gct cag gcc aaa gtt gac gaa gct tat aag 2400  
Phe Pro Ser Tyr Met Asp Ala Gln Ala Lys Val Asp Glu Ala Tyr Lys  
785 790 795 800

gac cgg aag ggg tgg ctg aaa atg tcg ata ttg agc aca gcc ggg tca 2448  
Asp Arg Lys Gly Trp Leu Lys Met Ser Ile Leu Ser Thr Ala Gly Ser  
805 810 815

gga aag ttc agc agt gac cgt aca ata gct cag tat gcc aaa gag att 2496  
Gly Lys Phe Ser Ser Asp Arg Thr Ile Ala Gln Tyr Ala Lys Glu Ile  
820 825 830

tgg aac att gag gct tgt cct gtt ccc taa 2526  
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35 40 45

Phe Gly Pro Glu Gln Ala Leu Tyr Ala Thr Ala Glu Ser Leu Arg Asp  
50 55 60

Arg Leu Ile Gln Leu Trp Asn Glu Thr Tyr Val His Phe Asn Lys Val  
65 70 75 80

Asp Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Tyr Leu Gln Gly Arg  
85 90 95

Ala Leu Thr Asn Ala Ile Gly Asn Leu Asn Leu Gln Gly Pro Tyr Ala  
100 105 110

Asp Ala Leu Arg Thr Leu Gly Tyr Glu Leu Glu Glu Ile Ala Glu Gln  
115 120 125

Glu Lys Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser  
130 135 140

Cys Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr  
145 150 155 160

Gly Leu Arg Tyr Arg His Gly Leu Phe Lys Gln Ile Ile Thr Lys Lys  
165 170 175

Gly Gln Glu Glu Ile Pro Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp  
180 185 190

Glu Ile Val Arg His Asp Val Val Phe Pro Val Arg Phe Phe Gly Lys  
195 200 205

Val Gln Val Asn Pro Asp Gly Ser Arg Lys Trp Val Asp Gly Asp Val  
210 215 220

Val Gln Ala Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr Gly Thr Lys  
225 230 235 240

Asn Thr Ile Ser Leu Arg Leu Trp Glu Ala Lys Ala Arg Ala Glu Asp  
245 250 255

Leu Asp Leu Phe Gln Phe Asn Glu Gly Glu Tyr Glu Leu Ala Ala Gln  
260 265 270

Leu His Ser Arg Ala Gln Gln Ile Cys Thr Val Leu Tyr Pro Gly Asp  
275 280 285

Ala Thr Glu Asn Gly Lys Leu Leu Arg Leu Lys Gln Gln Phe Phe Leu  
290 295 300

Cys Ser Ala Ser Leu Gln Asp Ile Ile Ser Arg Phe His Glu Arg Ser  
305 310 315 320

Thr Thr Glu Gly Ser Arg Lys Trp Ser Glu Phe Pro Ser Lys Val Ala  
325 330 335

Val Gln Met Asn Asp Thr His Pro Thr Leu Ala Ile Pro Glu Leu Met  
340 345 350



Lys Leu Lys Glu Met Lys Pro Glu Glu Arg Lys Lys Thr Val Pro Arg  
595 600 605

Thr Val Met Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys  
610 615 620

Arg Ile Val Lys Leu Val Asn Asp Val Gly Asp Val Val Asn Ser Asp  
625 630 635 640

Pro Glu Val Asn Glu Tyr Leu Lys Val Val Phe Val Pro Asn Tyr Asn  
645 650 655

Val Thr Val Ala Glu Met Leu Ile Pro Gly Ser Glu Leu Ser Gln His  
660 665 670

Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe  
675 680 685

Ala Leu Asn Gly Cys Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn Val  
690 695 700

Glu Ile Arg Glu Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala  
705 710 715 720

Thr Ala Asp Gln Val Pro Arg Leu Arg Lys Glu Arg Glu Asp Gly Leu  
725 730 735

Phe Lys Pro Asp Pro Arg Phe Glu Glu Ala Lys Gln Phe Val Lys Ser  
740 745 750

Gly Val Phe Gly Ser Tyr Asp Tyr Gly Pro Leu Leu Asp Ser Leu Glu  
755 760 765

Gly Asn Thr Gly Phe Gly Arg Gly Asp Tyr Phe Leu Val Gly Tyr Asp  
770 775 780

Phe Pro Ser Tyr Met Asp Ala Gln Ala Lys Val Asp Glu Ala Tyr Lys  
785 790 795 800

Asp Arg Lys Gly Trp Leu Lys Met Ser Ile Leu Ser Thr Ala Gly Ser  
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Pro Ile Ala Gln Pro Leu Ser Glu Asp Pro Thr Asp Ile Ala Ser Asn  
15 20 25

atc aag tat cat gct caa tat act cct cat ttt tct cct ttc aag ttt 146  
Ile Lys Tyr His Ala Gln Tyr Thr Pro His Phe Ser Pro Phe Lys Phe  
30 35 40 45

gag cca cta caa gca tac tat gct gct act gct gac agt gtt cgt gat 194  
Glu Pro Leu Gln Ala Tyr Tyr Ala Ala Thr Ala Asp Ser Val Arg Asp  
50 55 60

cgc ttg atc aaa caa tgg aat gac acc tat ctt cat tat gac aaa gtt 242  
Arg Leu Ile Lys Gln Trp Asn Asp Thr Tyr Leu His Tyr Asp Lys Val  
65 70 75

aat cca aag caa aca tac tac tta tca atg gag tat ctc cag ggg cga 290  
Asn Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Tyr Leu Gln Gly Arg  
80 85 90

gct ttg aca aat gca gtt gga aac tta gac atc cac aat gca tat gct 338  
Ala Leu Thr Asn Ala Val Gly Asn Leu Asp Ile His Asn Ala Tyr Ala  
95 100 105

gat gct tta aac aaa ctg ggt cag cag ctt gag gag gtc gtt gag cag 386  
Asp Ala Leu Asn Lys Leu Gly Gln Gln Leu Glu Glu Val Val Glu Gln  
110 115 120 125

gaa aaa gat gca gca tta gga aat ggt ggt tta gga agg ctc gct tca 434  
Glu Lys Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser  
130 135 140

tgc ttt ctt gat tcc atg gcc aca ttg aac ctt cca gca tgg ggt tat 482  
Cys Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr  
145 150 155

ggc ttg agg tac aga tat gga ctt ttt aag cag ctt atc aca aag gct 530  
Gly Leu Arg Tyr Arg Tyr Gly Leu Phe Lys Gln Leu Ile Thr Lys Ala  
160 165 170



ggg caa gaa gaa gtt cct gaa gat tgg ttg gag aaa ttt agt ccc tgg 578  
 Gly Gln Glu Glu Val Pro Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp  
 175 180 185

gaa att gta agg cat gat gtt gtc ttt cct atc agg ttt ttt ggt cat 626  
 Glu Ile Val Arg His Asp Val Val Phe Pro Ile Arg Phe Phe Gly His  
 190 195 200 205

gtt gaa gtc ctc cct tct ggc tcg cga aaa tgg gtt ggt gga gag gtc 674  
 Val Glu Val Leu Pro Ser Gly Ser Arg Lys Trp Val Gly Gly Glu Val  
 210 215 220

cta cag gct ctt gca tat gat gtg cca att cca gga tac aga act aaa 722  
 Leu Gln Ala Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr Arg Thr Lys  
 225 230 235

aac act aat agt ctt cgt ctc tgg gaa gcc aaa gca agc tct gag gat 770  
 Asn Thr Asn Ser Leu Arg Leu Trp Glu Ala Lys Ala Ser Ser Glu Asp  
 240 245 250

ttc aac ttg ttt ctg ttt aat gat gga cag tat gat gct gct gca cag 818  
 Phe Asn Leu Phe Leu Phe Asn Asp Gly Gln Tyr Asp Ala Ala Ala Gln  
 255 260 265

ctt cat tct agg gct cag cag att tgt gct gtt ctc tac cct ggg gat 866  
 Leu His Ser Arg Ala Gln Gln Ile Cys Ala Val Leu Tyr Pro Gly Asp  
 270 275 280 285

gct aca gag aat gga aaa ctc tta cgg cta aag caa caa ttt ttt ctg 914  
 Ala Thr Glu Asn Gly Lys Leu Leu Arg Leu Lys Gln Gln Phe Phe Leu  
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tgc agt gca tcg ctt cag gat att att gcc aga ttc aaa gag aga gaa 962  
 Cys Ser Ala Ser Leu Gln Asp Ile Ile Ala Arg Phe Lys Glu Arg Glu  
 305 310 315

gat gga aag ggt tct cac cag tgg tct gaa ttc ccc aag aag gtt gcg 1010  
 Asp Gly Lys Gly Ser His Gln Trp Ser Glu Phe Pro Lys Lys Val Ala  
 320 325 330

ata caa cta aat gac aca cat cca act ctt acg att cca gag ctg atg 1058  
 Ile Gln Leu Asn Asp Thr His Pro Thr Leu Thr Ile Pro Glu Leu Met  
 335 340 345

cgg ttg cta atg gat gat gaa gga ctt ggg tgg gat gaa tct tgg aat 1106  
 Arg Leu Leu Met Asp Asp Glu Gly Leu Gly Trp Asp Glu Ser Trp Asn  
 350 355 360 365

atc act act agg aca att gcc tat acg aat cat aca gtc cta cct gaa 1154  
 Ile Thr Thr Arg Thr Ile Ala Tyr Thr Asn His Thr Val Leu Pro Glu  
 370 375 380

gca ctt gaa aaa tgg tct cag gca gtc atg tgg aag ctc ctt cct aga 1202  
 Ala Leu Glu Lys Trp Ser Gln Ala Val Met Trp Lys Leu Leu Pro Arg  
 385 390 395

cat atg gaa atc att gaa gaa att gac aaa cgg ttt gtt gct aca ata 1250  
 His Met Glu Ile Ile Glu Glu Ile Asp Lys Arg Phe Val Ala Thr Ile  
 400 405 410

atg tca gaa aga cct gat ctt gag aat aag atg cct agc atg cgc att 1298  
Met Ser Glu Arg Pro Asp Leu Glu Asn Lys Met Pro Ser Met Arg Ile  
415 420 425

ttg gat cac aac gcc aca aaa cct gtt gtg cat atg gct aac ttg tgt 1346  
Leu Asp His Asn Ala Thr Lys Pro Val Val His Met Ala Asn Leu Cys  
430 435 440 445

gtt gtc tct tca cat acg gta aat ggt gtt gcc cag ctg cat agt gac 1394  
Val Val Ser Ser His Thr Val Asn Gly Val Ala Gln Leu His Ser Asp  
450 455 460

atc ctg aag gct gag tta ttt gct gat tat gtc tct gta tgg ccc acc 1442  
Ile Leu Lys Ala Glu Leu Phe Ala Asp Tyr Val Ser Val Trp Pro Thr  
465 470 475

aag ttc cag aat aag acc aat ggt ata act cct cgt agg tgg atc cga 1490  
Lys Phe Gln Asn Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Ile Arg  
480 485 490

ttt tgt agt cct gag ctg agt cat ata att acc aag tgg tta aaa aca 1538  
Phe Cys Ser Pro Glu Leu Ser His Ile Ile Thr Lys Trp Leu Lys Thr  
495 500 505

gat caa tgg gtg acg aac ctc gaa ctg ctt gct aat ctt cgg gag ttt 1586  
Asp Gln Trp Val Thr Asn Leu Glu Leu Leu Ala Asn Leu Arg Glu Phe  
510 515 520 525

gct gat aat tcg gag ctc cat gct gaa tgg gaa tca gcc aag atg gcc 1634  
Ala Asp Asn Ser Glu Leu His Ala Glu Trp Glu Ser Ala Lys Met Ala  
530 535 540

aac aag cag cgt ttg gca cag tat ata ctg cat gtg aca ggt gtg agc 1682  
Asn Lys Gln Arg Leu Ala Gln Tyr Ile Leu His Val Thr Gly Val Ser  
545 550 555

atc gat cca aat tcc ctt ttt gac ata caa gtc aaa cgt atc cat gaa 1730  
Ile Asp Pro Asn Ser Leu Phe Asp Ile Gln Val Lys Arg Ile His Glu  
560 565 570

tac aaa agg cag ctt cta aat att ctg ggc gtc atc tat aga tac aag 1778  
Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly Val Ile Tyr Arg Tyr Lys  
575 580 585

aag ctt aag gga atg agc cct gaa gaa agg aaa aat aca act cct cgc 1826  
Lys Leu Lys Gly Met Ser Pro Glu Glu Arg Lys Asn Thr Thr Pro Arg  
590 595 600 605

aca gtc atg att gga gga aaa gca ttt gca aca tac aca aat gca aaa 1874  
Thr Val Met Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys  
610 615 620

cga att gtc aag ctc gtg act gat gtt ggc gac gtt gtc aat agt gac 1922  
Arg Ile Val Lys Leu Val Thr Asp Val Gly Asp Val Val Asn Ser Asp  
625 630 635

cct gac gtc aat gac tat ttg aag gtg gtt ttt gtt ccc aac tac aat 1970  
Pro Asp Val Asn Asp Tyr Leu Lys Val Val Phe Val Pro Asn Tyr Asn  
640 645 650

gta tct gtg gca gag atg ctt att ccg gga agt gag cta tca caa cac 2018  
 Val Ser Val Ala Glu Met Leu Ile Pro Gly Ser Glu Leu Ser Gln His  
 655 660 665

atc agt act gca ggc atg gaa gca agt gga aca agc aac atg aaa ttt 2066  
 Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe  
 670 675 680 685

gcc ctt aat gga tgc ctt atc att ggg aca cta gat ggg gcc aat gtg 2114  
 Ala Leu Asn Gly Cys Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn Val  
 690 695 700

gaa att agg gag gaa att gga gaa gat aac ttc ttt ctt ttt ggt gca 2162  
 Glu Ile Arg Glu Glu Ile Gly Glu Asp Asn Phe Phe Leu Phe Gly Ala  
 705 710 715

aca gct gat gaa gtt cct caa ctg cgc aaa gat cga gag aat gga ctg 2210  
 Thr Ala Asp Glu Val Pro Gln Leu Arg Lys Asp Arg Glu Asn Gly Leu  
 720 725 730

ttc aaa cct gat cct cgg ttt gaa gag gca aaa caa ttt att agg tct 2258  
 Phe Lys Pro Asp Pro Arg Phe Glu Glu Ala Lys Gln Phe Ile Arg Ser  
 735 740 745

gga gca ttt ggg acg tat gat tat aat ccc ctc ctt gaa tca ctg gaa 2306  
 Gly Ala Phe Gly Thr Tyr Asp Tyr Asn Pro Leu Leu Glu Ser Leu Glu  
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ggg aac tcg gga tat ggt cgt gga gac tat ttt ctt gtt ggt cat gat 2354  
 Gly Asn Ser Gly Tyr Gly Arg Gly Asp Tyr Phe Leu Val Gly His Asp  
 770 775 780

ttt ccg agc tac atg gat gct cag gca agg gtt gat gaa gct tac aag 2402  
 Phe Pro Ser Tyr Met Asp Ala Gln Ala Arg Val Asp Glu Ala Tyr Lys  
 785 790 795

gac agg aaa aga tgg ata aag atg tct ata ctg agc act agt ggg agt 2450  
 Asp Arg Lys Arg Trp Ile Lys Met Ser Ile Leu Ser Thr Ser Gly Ser  
 800 805 810

ggc aaa ttt agt agt gac cgt aca att tct caa tat gca aaa gag atc 2498  
 Gly Lys Phe Ser Ser Asp Arg Thr Ile Ser Gln Tyr Ala Lys Glu Ile  
 815 820 825

tgg aac att gcc gag tgt cgc gtg cct tga gcacacttct gaacctgcta 2548  
 Trp Asn Ile Ala Glu Cys Arg Val Pro  
 830 835

totaataagg atctaattgtt cattgtttac tagcatatga ataataatga ttcaagcaca 2608  
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His Ala Gln Tyr Thr Pro His Phe Ser Pro Phe Lys Phe Glu Pro Leu  
35 40 45

Gln Ala Tyr Tyr Ala Ala Thr Ala Asp Ser Val Arg Asp Arg Leu Ile  
50 55 60

Lys Gln Trp Asn Asp Thr Tyr Leu His Tyr Asp Lys Val Asn Pro Lys  
65 70 75 80

Gln Thr Tyr Tyr Leu Ser Met Glu Tyr Leu Gln Gly Arg Ala Leu Thr  
85 90 95

Asn Ala Val Gly Asn Leu Asp Ile His Asn Ala Tyr Ala Asp Ala Leu  
100 105 110

Asn Lys Leu Gly Gln Gln Leu Glu Glu Val Val Glu Gln Glu Lys Asp  
115 120 125

Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser Cys Phe Leu  
130 135 140

Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr Gly Leu Arg  
145 150 155 160

Tyr Arg Tyr Gly Leu Phe Lys Gln Leu Ile Thr Lys Ala Gly Gln Glu  
165 170 175

Glu Val Pro Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp Glu Ile Val  
180 185 190

Arg His Asp Val Val Phe Pro Ile Arg Phe Phe Gly His Val Glu Val  
195 200 205

Leu Pro Ser Gly Ser Arg Lys Trp Val Gly Gly Glu Val Leu Gln Ala  
210 215 220

Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr Arg Thr Lys Asn Thr Asn  
225 230 235 240

Ser Leu Arg Leu Trp Glu Ala Lys Ala Ser Ser Glu Asp Phe Asn Leu  
245 250 255

Phe Leu Phe Asn Asp Gly Gln Tyr Asp Ala Ala Ala Gln Leu His Ser  
260 265 270

Arg Ala Gln Gln Ile Cys Ala Val Leu Tyr Pro Gly Asp Ala Thr Glu  
275 280 285

Asn Gly Lys Leu Leu Arg Leu Lys Gln Gln Phe Phe Leu Cys Ser Ala  
290 295 300

Ser Leu Gln Asp Ile Ile Ala Arg Phe Lys Glu Arg Glu Asp Gly Lys  
305 310 315 320

Gly Ser His Gln Trp Ser Glu Phe Pro Lys Lys Val Ala Ile Gln Leu  
325 330 335

Asn Asp Thr His Pro Thr Leu Thr Ile Pro Glu Leu Met Arg Leu Leu  
340 345 350

Met Asp Asp Glu Gly Leu Gly Trp Asp Glu Ser Trp Asn Ile Thr Thr  
355 360 365

Arg Thr Ile Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala Leu Glu  
370 375 380

Lys Trp Ser Gln Ala Val Met Trp Lys Leu Leu Pro Arg His Met Glu  
385 390 395 400

Ile Ile Glu Glu Ile Asp Lys Arg Phe Val Ala Thr Ile Met Ser Glu  
405 410 415

Arg Pro Asp Leu Glu Asn Lys Met Pro Ser Met Arg Ile Leu Asp His  
420 425 430

Asn Ala Thr Lys Pro Val Val His Met Ala Asn Leu Cys Val Val Ser  
435 440 445

Ser His Thr Val Asn Gly Val Ala Gln Leu His Ser Asp Ile Leu Lys  
450 455 460

Ala Glu Leu Phe Ala Asp Tyr Val Ser Val Trp Pro Thr Lys Phe Gln  
465 470 475 480

Asn Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Ile Arg Phe Cys Ser  
485 490 495

Pro Glu Leu Ser His Ile Ile Thr Lys Trp Leu Lys Thr Asp Gln Trp  
500 505 510

Val Thr Asn Leu Glu Leu Leu Ala Asn Leu Arg Glu Phe Ala Asp Asn  
515 520 525

Ser Glu Leu His Ala Glu Trp Glu Ser Ala Lys Met Ala Asn Lys Gln  
530 535 540

Arg Leu Ala Gln Tyr Ile Leu His Val Thr Gly Val Ser Ile Asp Pro  
545 550 555 560

Asn Ser Leu Phe Asp Ile Gln Val Lys Arg Ile His Glu Tyr Lys Arg  
565 570 575

Gln Leu Leu Asn Ile Leu Gly Val Ile Tyr Arg Tyr Lys Lys Leu Lys  
580 585 590

Gly Met Ser Pro Glu Glu Arg Lys Asn Thr Thr Pro Arg Thr Val Met  
595 600 605

Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys Arg Ile Val  
610 615 620

Lys Leu Val Thr Asp Val Gly Asp Val Val Asn Ser Asp Pro Asp Val  
625 630 635 640

Asn Asp Tyr Leu Lys Val Val Phe Val Pro Asn Tyr Asn Val Ser Val  
645 650 655

Ala Glu Met Leu Ile Pro Gly Ser Glu Leu Ser Gln His Ile Ser Thr  
660 665 670

Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Leu Asn  
675 680 685

Gly Cys Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile Arg  
690 695 700

Glu Glu Ile Gly Glu Asp Asn Phe Phe Leu Phe Gly Ala Thr Ala Asp  
705 710 715 720

Glu Val Pro Gln Leu Arg Lys Asp Arg Glu Asn Gly Leu Phe Lys Pro  
725 730 735

Asp Pro Arg Phe Glu Glu Ala Lys Gln Phe Ile Arg Ser Gly Ala Phe  
740 745 750

Gly Thr Tyr Asp Tyr Asn Pro Leu Leu Glu Ser Leu Glu Gly Asn Ser  
755 760 765

Gly Tyr Gly Arg Gly Asp Tyr Phe Leu Val Gly His Asp Phe Pro Ser  
770 775 780

Tyr Met Asp Ala Gln Ala Arg Val Asp Glu Ala Tyr Lys Asp Arg Lys  
785 790 795 800

Arg Trp Ile Lys Met Ser Ile Leu Ser Thr Ser Gly Ser Gly Lys Phe  
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1 5 10 15

ttg cca gcc tgg ggt tat gga ttg agg tac aaa cat gga ctg ttc aag 97  
Leu Pro Ala Trp Gly Tyr Gly Leu Arg Tyr Lys His Gly Leu Phe Lys  
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caa cgt atc acc aaa gca gga caa gag gag att gct gaa gat tgg ctg 145  
Gln Arg Ile Thr Lys Ala Gly Gln Glu Ile Ala Glu Asp Trp Leu  
35 40 45

gag aaa ttc agt ccc tgg gaa gtt gca agg cat gac att gtc ttc ccc 193  
Glu Lys Phe Ser Pro Trp Glu Val Ala Arg His Asp Ile Val Phe Pro  
50 55 60

atc aga ttt ttt ggt cac gtt gag gtt gat cct agt ggc tcc cgg aaa 241

Ile Arg Phe Phe Gly His Val Glu Val Asp Pro Ser Gly Ser Arg Lys  
65 70 75 80

tgg gtt ggt ggt gag gtc ata cag gct gtt gca tat gat gtt cct att 289  
Trp Val Gly Gly Glu Val Ile Gln Ala Val Ala Tyr Asp Val Pro Ile  
85 90 95

cct ggg tat aaa aca aag aat act att agt ctt cga cta tgg gaa gcc 337  
Pro Gly Tyr Lys Thr Lys Asn Thr Ile Ser Leu Arg Leu Trp Glu Ala  
100 105 110

aaa gcc agt gca gag gac tta aac tta tct caa ttt aat gat ggg caa 385  
Lys Ala Ser Ala Glu Asp Leu Asn Leu Ser Gln Phe Asn Asp Gly Gln  
115 120 125

tat gaa tct gct aca ctg ctt cat tct cgg gct cat cag att tgt gct 433  
Tyr Glu Ser Ala Thr Leu Leu His Ser Arg Ala His Gln Ile Cys Ala  
130 135 140

gtc ctt tac cct ggg gat gca acg gaa agt gga aaa ctt tta cga ctt 481  
Val Leu Tyr Pro Gly Asp Ala Thr Glu Ser Gly Lys Leu Leu Arg Leu  
145 150 155 160

aaa caa caa ttt ttg ctg tgt agt gca tct ctt cag gac atc ata ttc 529  
Lys Gln Gln Phe Leu Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Phe  
165 170 175

aga ttt aag gag agg aat gat ggg aag ggc act ctt gat tgg tcc aca 577  
Arg Phe Lys Glu Arg Asn Asp Gly Lys Gly Thr Leu Asp Trp Ser Thr  
180 185 190

ttc ccc aca aaa gtt gca gta caa ctg aat gac aca cat cct acg ctc 625  
Phe Pro Thr Lys Val Ala Val Gln Leu Asn Asp Thr His Pro Thr Leu  
195 200 205

tcg att ccg gag ctg atg cgg tta ttg atg gat gat gaa gga ctt gga 673  
Ser Ile Pro Glu Leu Met Arg Leu Leu Met Asp Asp Glu Gly Leu Gly  
210 215 220

tgg gat gaa gca tgg gat ata acc act agg aca atc gct tat aca aat 721  
Trp Asp Glu Ala Trp Asp Ile Thr Thr Arg Thr Ile Ala Tyr Thr Asn  
225 230 235 240

cat acc gtc cta cct gaa gca cta gaa aaa tgg tca caa gca gtc atg 769  
His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Gln Ala Val Met  
245 250 255

tgg aaa ctt ctt cca cgg cat atg gaa atc att gag gaa atc gac aag 817  
Trp Lys Leu Leu Pro Arg His Met Glu Ile Ile Glu Glu Ile Asp Lys  
260 265 270

cgg ttt att gca atg ata caa tca aag ata cct aat ctt gag agt aag 865  
Arg Phe Ile Ala Met Ile Gln Ser Lys Ile Pro Asn Leu Glu Ser Lys  
275 280 285

atc tct gcc ata tgc att ttg gat cac aat ccc cag aag cct gtt gtg 913  
Ile Ser Ala Ile Cys Ile Leu Asp His Asn Pro Gln Lys Pro Val Val  
290 295 300

cgt atg gct aat ttg tgt gtc atc tct tcg cat acg gtg aat ggt gtt 961



Arg Met Ala Asn Leu Cys Val Ile Ser Ser His Thr Val Asn Gly Val  
305 310 315 320

gcc cag cta cac agt gat atc ttg aag gat gaa tta ttc atc gac tat 1009  
Ala Gln Leu His Ser Asp Ile Leu Lys Asp Glu Leu Phe Ile Asp Tyr  
325 330 335

gtc tct atc tgg ccc acc aaa ttc cag aac aaa acc aac ggc ata aca 1057  
Val Ser Ile Trp Pro Thr Lys Phe Gln Asn Lys Thr Asn Gly Ile Thr  
340 345 350

cca cgg cgg tgg ctt agg ttt tgc aat ccc gag ctg agt gat ata atc 1105  
Pro Arg Arg Trp Leu Arg Phe Cys Asn Pro Glu Leu Ser Asp Ile Ile  
355 360 365

acc aag tgg tta aaa act gat gaa tgg gtg act aat ctt gat ttg ctt 1153  
Thr Lys Trp Leu Lys Thr Asp Glu Trp Val Thr Asn Leu Asp Leu Leu  
370 375 380

act aat ctg cgg aag ttt gct gac gat gaa caa ctc cat gct caa tgg 1201  
Thr Asn Leu Arg Lys Phe Ala Asp Asp Glu Gln Leu His Ala Gln Trp  
385 390 395 400

gag tct gcc aag atg gca agc aag caa cga ttg gcg cag tac ata ctg 1249  
Glu Ser Ala Lys Met Ala Ser Lys Gln Arg Leu Ala Gln Tyr Ile Leu  
405 410 415

cga gta acc ggt gtg cgt gtt gac cca aat aca cta ttt gac ata caa 1297  
Arg Val Thr Gly Val Arg Val Asp Pro Asn Thr Leu Phe Asp Ile Gln  
420 425 430

gtc aag cgc att cac gaa tac aaa agg cag ctg cta aat gta ttg ggt 1345  
Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Leu Asn Val Leu Gly  
435 440 445

gta gtc tac cgg tac aag aaa ctg aag gag atg aaa ccc gaa gag cgt 1393  
Val Val Tyr Arg Tyr Lys Lys Leu Lys Glu Met Lys Pro Glu Glu Arg  
450 455 460

aag aat aca aca gca cgc act gtc atg ctc ggg gga aaa gca ttt gcg 1441  
Lys Asn Thr Thr Ala Arg Thr Val Met Leu Gly Gly Lys Ala Phe Ala  
465 470 475 480

acc tat aca aat gca aaa agg atc atc aag ctt gtg acg gat gtt ggg 1489  
Thr Tyr Thr Asn Ala Lys Arg Ile Ile Lys Leu Val Thr Asp Val Gly  
485 490 495

gat gtt gtc aat agt gat cct gag gtc aat agc tat ttg aag gta gtc 1537  
Asp Val Val Asn Ser Asp Pro Glu Val Asn Ser Tyr Leu Lys Val Val  
500 505 510

ttt gta ccc aat tac aac gta tct gtg gca gaa gtg ctt att ccg gga 1585  
Phe Val Pro Asn Tyr Asn Val Ser Val Ala Glu Val Leu Ile Pro Gly  
515 520 525

agt gag ctt tca cag cac atc agc aca gct ggc 1618  
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Gln Arg Ile Thr Lys Ala Gly Gln Glu Glu Ile Ala Glu Asp Trp Leu  
35 40 45

Glu Lys Phe Ser Pro Trp Glu Val Ala Arg His Asp Ile Val Phe Pro  
50 55 60

Ile Arg Phe Phe Gly His Val Glu Val Asp Pro Ser Gly Ser Arg Lys  
65 70 75 80

Trp Val Gly Gly Glu Val Ile Gln Ala Val Ala Tyr Asp Val Pro Ile  
85 90 95

Pro Gly Tyr Lys Thr Lys Asn Thr Ile Ser Leu Arg Leu Trp Glu Ala  
100 105 110

Lys Ala Ser Ala Glu Asp Leu Asn Leu Ser Gln Phe Asn Asp Gly Gln  
115 120 125

Tyr Glu Ser Ala Thr Leu Leu His Ser Arg Ala His Gln Ile Cys Ala  
130 135 140

Val Leu Tyr Pro Gly Asp Ala Thr Glu Ser Gly Lys Leu Leu Arg Leu  
145 150 155 160

Lys Gln Gln Phe Leu Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Phe  
165 170 175

Arg Phe Lys Glu Arg Asn Asp Gly Lys Gly Thr Leu Asp Trp Ser Thr  
180 185 190

Phe Pro Thr Lys Val Ala Val Gln Leu Asn Asp Thr His Pro Thr Leu  
195 200 205

Ser Ile Pro Glu Leu Met Arg Leu Leu Met Asp Asp Glu Gly Leu Gly

210

215

220

Trp Asp Glu Ala Trp Asp Ile Thr Thr Arg Thr Ile Ala Tyr Thr Asn  
225 230 235 240

His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Gln Ala Val Met  
245 250 255

Trp Lys Leu Leu Pro Arg His Met Glu Ile Ile Glu Glu Ile Asp Lys  
260 265 270

Arg Phe Ile Ala Met Ile Gln Ser Lys Ile Pro Asn Leu Glu Ser Lys  
275 280 285

Ile Ser Ala Ile Cys Ile Leu Asp His Asn Pro Gln Lys Pro Val Val  
290 295 300

Arg Met Ala Asn Leu Cys Val Ile Ser Ser His Thr Val Asn Gly Val  
305 310 315 320

Ala Gln Leu His Ser Asp Ile Leu Lys Asp Glu Leu Phe Ile Asp Tyr  
325 330 335

Val Ser Ile Trp Pro Thr Lys Phe Gln Asn Lys Thr Asn Gly Ile Thr  
340 345 350

Pro Arg Arg Trp Leu Arg Phe Cys Asn Pro Glu Leu Ser Asp Ile Ile  
355 360 365

Thr Lys Trp Leu Lys Thr Asp Glu Trp Val Thr Asn Leu Asp Leu Leu  
370 375 380

Thr Asn Leu Arg Lys Phe Ala Asp Asp Glu Gln Leu His Ala Gln Trp  
385 390 395 400

Glu Ser Ala Lys Met Ala Ser Lys Gln Arg Leu Ala Gln Tyr Ile Leu  
405 410 415

Arg Val Thr Gly Val Arg Val Asp Pro Asn Thr Leu Phe Asp Ile Gln  
420 425 430

Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Leu Asn Val Leu Gly  
435 440 445

Val Val Tyr Arg Tyr Lys Lys Leu Lys Glu Met Lys Pro Glu Glu Arg

450

455

460

Lys Asn Thr Thr Ala Arg Thr Val Met Leu Gly Gly Lys Ala Phe Ala  
 465 470 475 480

Thr Tyr Thr Asn Ala Lys Arg Ile Ile Lys Leu Val Thr Asp Val Gly  
 485 490 495

Asp Val Val Asn Ser Asp Pro Glu Val Asn Ser Tyr Leu Lys Val Val  
 500 505 510

Phe Val Pro Asn Tyr Asn Val Ser Val Ala Glu Val Leu Ile Pro Gly  
 515 520 525

Ser Glu Leu Ser Gln His Ile Ser Thr Ala Gly  
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&lt;223&gt; a mutant of a potato type L alpha-glucan phosphorylase

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&lt;400&gt; 33

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 Glu Ser Asp Leu Ser Ser Phe Ala Pro Asp Ala Ala Ser Ile Thr Ser  
 20 25 30

agt atc aaa tac cat gca gaa ctc aca cct gta ttc tct cct gaa agg 144  
 Ser Ile Lys Tyr His Ala Glu Leu Thr Pro Val Phe Ser Pro Glu Arg  
 35 40 45

ttt gag ctc cct aag gca ttc ttt gca aca gct caa agt gtt cgt gat 192  
 Phe Glu Leu Pro Lys Ala Phe Phe Ala Thr Ala Gln Ser Val Arg Asp  
 50 55 60

tcg ctc ctt att aat tgg aat gct acg tat gat att tat gaa aag ctg 240  
 Ser Leu Leu Ile Asn Trp Asn Ala Thr Tyr Asp Ile Tyr Glu Lys Leu  
 65 70 75

aac atg aag caa gcg tac tat cta tcc atg gaa ttt ctg cag ggt aga 288  
 Asn Met Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu Gln Gly Arg  
 80 85 90 95

gca ttg tta aat gca att ggt aat ctg gag ctt act ggt gca ttt gcg 336  
 Ala Leu Leu Asn Ala Ile Gly Asn Leu Glu Leu Thr Gly Ala Phe Ala  
 100 105 110

gaa gct ttg aaa aac ctt ggt cac aat cta gaa aat gtg gct tct cag 384  
 Glu Ala Leu Lys Asn Leu Gly His Asn Leu Glu Asn Val Ala Ser Gln  
 115 120 125

gaa cca gat gct gct ctt gga agt ggg ggt ttg gga cgg ctt gct tcc 432  
 Glu Pro Asp Ala Ala Leu Gly Ser Gly Leu Gly Arg Leu Ala Ser  
 130 135 140

tgt ttt ctg gac tct ttg gca aca cta aac tac cca gca tgg ggc tat 480  
 Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala Trp Gly Tyr  
 145 150 155

gga ctt agg tac aag tat ggt tta ttt aag caa cgg att aca aaa gat 528  
 Gly Leu Arg Tyr Lys Tyr Gly Leu Phe Lys Gln Arg Ile Thr Lys Asp  
 160 165 170 175

ggt cag gag gag gtg gct gaa gat tgg ctt gaa att ggc agt cca tgg 576  
 Gly Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Ile Gly Ser Pro Trp  
 180 185 190

gaa gtt gtg agg aat gat gtt tca tat cct atc aaa ttc tat gga aaa 624  
 Glu Val Val Arg Asn Asp Val Ser Tyr Pro Ile Lys Phe Tyr Gly Lys  
 195 200 205

gtc tct aca gga tca gat gga aag agg tat tgg att ggt gga gag gat 672  
 Val Ser Thr Gly Ser Asp Gly Lys Arg Tyr Trp Ile Gly Gly Glu Asp  
 210 215 220

ata aag gca gtt gcg tat gat gtt ccc ata cca ggg tat aag acc aga 720  
 Ile Lys Ala Val Ala Tyr Asp Val Pro Ile Pro Gly Tyr Lys Thr Arg  
 225 230 235

acc aca atc agc ctt cga ctg tgg tct aca cag gtt cca tca gcg gat 768  
 Thr Thr Ile Ser Leu Arg Leu Trp Ser Thr Gln Val Pro Ser Ala Asp  
 240 245 250 255

ttt gat tta tct gct ttc aat gct gga gag cac acc aaa gca tgt gaa 816  
 Phe Asp Leu Ser Ala Phe Asn Ala Gly Glu His Thr Lys Ala Cys Glu  
 260 265 270

gcc caa gca aac gct gag aag ata tgt tac ata ctc tac cct ggg gat 864  
 Ala Gln Ala Asn Ala Glu Lys Ile Cys Tyr Ile Leu Tyr Pro Gly Asp  
 275 280 285

gaa tca gag gag gga aag atc ctt cgg ttg aag caa caa tat acc tta 912  
 Glu Ser Glu Glu Gly Lys Ile Leu Arg Leu Lys Gln Gln Tyr Thr Leu  
 290 295 300

tgc tcg gct tct ctc caa gat att att tct cga ttt gag agg aga tca 960  
 Cys Ser Ala Ser Leu Gln Asp Ile Ile Ser Arg Phe Glu Arg Arg Ser  
 305 310 315

ggt gat cgt att aag tgg gaa gag ttt cct gaa aaa gtt gct gtg cag 1008  
Gly Asp Arg Ile Lys Trp Glu Glu Phe Pro Glu Lys Val Ala Val Gln  
320 325 330 335

atg aat gac act cac cct aca ctt tgt atc cct gag ctg atg aga ata 1056  
Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu Leu Met Arg Ile  
340 345 350

ttg ata gat ctg aag ggc ttg aat tgg aat gaa gct tgg aat att act 1104  
Leu Ile Asp Leu Lys Gly Leu Asn Trp Asn Glu Ala Trp Asn Ile Thr  
355 360 365

caa aga act gtg gcc tac aca aac cat act gtt ttg cct gag gca ctg 1152  
Gln Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala Leu  
370 375 380

gag aaa tgg agt tat gaa ttg atg cag aaa ctg ctt ccc aga cat gtc 1200  
Glu Lys Trp Ser Tyr Glu Leu Met Gln Lys Leu Leu Pro Arg His Val  
385 390 395

gaa atc att gag gcg att gac gag gag ctg gta cat gaa att gta tta 1248  
Glu Ile Ile Glu Ala Ile Asp Glu Glu Leu Val His Glu Ile Val Leu  
400 405 410 415

aaa tat ggt tca atg gat ctg aac aaa ttg gag gaa aag ttg act aca 1296  
Lys Tyr Gly Ser Met Asp Leu Asn Lys Leu Glu Glu Lys Leu Thr Thr  
420 425 430

atg aga atc tta gaa aat ttt gat ctt ccc agt cct gtt gct gaa tta 1344  
Met Arg Ile Leu Glu Asn Phe Asp Leu Pro Ser Pro Val Ala Glu Leu  
435 440 445

ttt att aag cct gaa atc tca gtt gat gat gat act gaa aca gta gaa 1392  
Phe Ile Lys Pro Glu Ile Ser Val Asp Asp Asp Thr Glu Thr Val Glu  
450 455 460

gtc cat gac aaa gtt gaa gct tcc gat aaa gtt gtg act aat gat gaa 1440  
Val His Asp Lys Val Glu Ala Ser Asp Lys Val Val Thr Asn Asp Glu  
465 470 475

gat gac act ggt aag aaa act agt gtg aag ata gaa gca gct gca gaa 1488  
Asp Asp Thr Gly Lys Lys Thr Ser Val Lys Ile Glu Ala Ala Ala Glu  
480 485 490 495

aaa gac att gac aag aaa act ccc gtg agt ccg gaa cca gct gtt ata 1536  
Lys Asp Ile Asp Lys Lys Thr Pro Val Ser Pro Glu Pro Ala Val Ile  
500 505 510

cca cct aag aag gta cgc atg gcc aac ttg tgt gtt gtg ggc ggc cat 1584  
Pro Pro Lys Lys Val Arg Met Ala Asn Leu Cys Val Val Gly Gly His  
515 520 525

gct gtt aat gga gtt gct gag atc cat agt gaa att gtg aag gag gag 1632  
Ala Val Asn Gly Val Ala Glu Ile His Ser Glu Ile Val Lys Glu Glu  
530 535 540

ggt ttc aat gac ttc tat gag ctc tgg ccg gaa aag ttc caa aac aaa 1680  
Val Phe Asn Asp Phe Tyr Glu Leu Trp Pro Glu Lys Phe Gln Asn Lys  
545 550 555

aca aat gga gtg act cca aga aga tgg att cgt ttc tgc aat cct cct 1728  
 Thr Asn Gly Val Thr Pro Arg Arg Trp Ile Arg Phe Cys Asn Pro Pro  
 560 565 570 575

ctt agt gcc atc ata act aag tgg act ggt aca gag gat tgg gtc ctg 1776  
 Leu Ser Ala Ile Ile Thr Lys Trp Thr Gly Thr Glu Asp Trp Val Leu  
 580 585 590

aaa act gaa aag ttg gca gaa ttg cag aag ttt gct gat aat gaa gat 1824  
 Lys Thr Glu Lys Leu Ala Glu Leu Gln Lys Phe Ala Asp Asn Glu Asp  
 595 600 605

ctt caa aat gag tgg agg gaa gca aaa agg agc aac aag att aaa gtt 1872  
 Leu Gln Asn Glu Trp Arg Glu Ala Lys Arg Ser Asn Lys Ile Lys Val  
 610 615 620

gtc tcc ttt ctc aaa gaa aag aca ggg tat tct gtt gtc cca gat gca 1920  
 Val Ser Phe Leu Lys Glu Lys Thr Gly Tyr Ser Val Val Pro Asp Ala  
 625 630 635

atg ttt gat att cag gta aaa cgc att cat gag tac aag cga caa ctg 1968  
 Met Phe Asp Ile Gln Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu  
 640 645 650 655

tta aat atc ttc ggc atc gtt tat cgg tat aag aag atg aaa gaa atg 2016  
 Leu Asn Ile Phe Gly Ile Val Tyr Arg Tyr Lys Lys Met Lys Glu Met  
 660 665 670

aca gct gca gaa aga aag act aac ttc gtt cct cga gta tgc ata ttt 2064  
 Thr Ala Ala Glu Arg Lys Thr Asn Phe Val Pro Arg Val Cys Ile Phe  
 675 680 685

ggg gga aaa gct ttt gcc aca tat gtg caa gcc aag agg att gta aaa 2112  
 Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln Ala Lys Arg Ile Val Lys  
 690 695 700

ttt atc ata gat gtt ggt gct act ata aat cat gat cca gaa atc ggt 2160  
 Phe Ile Ile Asp Val Gly Ala Thr Ile Asn His Asp Pro Glu Ile Gly  
 705 710 715

gat ctg ttg aag gta gtc ttt gtg cca gat tac aat gtc agt gtt gct 2208  
 Asp Leu Leu Lys Val Val Phe Val Pro Asp Tyr Asn Val Ser Val Ala  
 720 725 730 735

gaa ttg cta att cct gct agc gat cta tca gaa cat atc agt acg gct 2256  
 Glu Leu Leu Ile Pro Ala Ser Asp Leu Ser Glu His Ile Ser Thr Ala  
 740 745 750

gga atg gag gcc agt gga acc agt aat atg aag ttt gca atg aat ggt 2304  
 Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Met Asn Gly  
 755 760 765

tgt atc caa att ggt aca ttg gat ggc gct aat gtt gaa ata agg gaa 2352  
 Cys Ile Gln Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu  
 770 775 780

gag gtt gga gaa gaa aac ttc ttt ctc ttt ggt gct caa gct cat gaa 2400  
 Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Gln Ala His Glu  
 785 790 795

att gca ggg ctt aga aaa gaa aga gct gac gga aag ttt gta cct gat 2448  
 Ile Ala Gly Leu Arg Lys Glu Arg Ala Asp Gly Lys Phe Val Pro Asp  
 800 805 810 815

gaa cgt ttt gaa gag gtg aag gaa ttt gtt aga agc ggt gct ttt ggc 2496  
 Glu Arg Phe Glu Glu Val Lys Glu Phe Val Arg Ser Gly Ala Phe Gly  
 820 825 830

tct tat aac tat gat gac cta att gga tcg ttg gaa gga aat gaa ggt 2544  
 Ser Tyr Asn Tyr Asp Asp Leu Ile Gly Ser Leu Glu Gly Asn Glu Gly  
 835 840 845

ttt ggc cgt gct gac tat ttc ctt gtg ggc aag gac ttc ccc agt tac 2592  
 Phe Gly Arg Ala Asp Tyr Phe Leu Val Gly Lys Asp Phe Pro Ser Tyr  
 850 855 860

ata gaa tgc caa gag aaa gtt gat gag gca tat cgc gac cag aaa agg 2640  
 Ile Glu Cys Gln Glu Lys Val Asp Glu Ala Tyr Arg Asp Gln Lys Arg  
 865 870 875

tgg aca acg atg tca atc ttg aat aca gcg gga tcg tac aag ttc agc 2688  
 Trp Thr Thr Met Ser Ile Leu Asn Thr Ala Gly Ser Tyr Lys Phe Ser  
 880 885 890 895

agt gac aga aca atc cat gaa tat gcc aaa gac att tgg aac att gaa 2736  
 Ser Asp Arg Thr Ile His Glu Tyr Ala Lys Asp Ile Trp Asn Ile Glu  
 900 905 910

gct gtg gaa ata gca taa 2754  
 Ala Val Glu Ile Ala  
 915

<210> 34  
 <211> 917  
 <212> PRT  
 <213> Artificial sequence

<220>  
 <223> Synthetic Construct

<400> 34

Met Thr Leu Ser Glu Lys Ile His His Pro Ile Thr Glu Gln Gly Gly  
 -1 1 5 10 15

Glu Ser Asp Leu Ser Ser Phe Ala Pro Asp Ala Ala Ser Ile Thr Ser  
 20 25 30

Ser Ile Lys Tyr His Ala Glu Leu Thr Pro Val Phe Ser Pro Glu Arg  
 35 40 45

Phe Glu Leu Pro Lys Ala Phe Phe Ala Thr Ala Gln Ser Val Arg Asp  
 50 55 60



Ser Leu Leu Ile Asn Trp Asn Ala Thr Tyr Asp Ile Tyr Glu Lys Leu  
65 70 75

Asn Met Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu Gln Gly Arg  
80 85 90 95

Ala Leu Leu Asn Ala Ile Gly Asn Leu Glu Leu Thr Gly Ala Phe Ala  
100 105 110

Glu Ala Leu Lys Asn Leu Gly His Asn Leu Glu Asn Val Ala Ser Gln  
115 120 125

Glu Pro Asp Ala Ala Leu Gly Ser Gly Gly Leu Gly Arg Leu Ala Ser  
130 135 140

Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala Trp Gly Tyr  
145 150 155

Gly Leu Arg Tyr Lys Tyr Gly Leu Phe Lys Gln Arg Ile Thr Lys Asp  
160 165 170 175

Gly Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Ile Gly Ser Pro Trp  
180 185 190

Glu Val Val Arg Asn Asp Val Ser Tyr Pro Ile Lys Phe Tyr Gly Lys  
195 200 205

Val Ser Thr Gly Ser Asp Gly Lys Arg Tyr Trp Ile Gly Gly Glu Asp  
210 215 220

Ile Lys Ala Val Ala Tyr Asp Val Pro Ile Pro Gly Tyr Lys Thr Arg  
225 230 235

Thr Thr Ile Ser Leu Arg Leu Trp Ser Thr Gln Val Pro Ser Ala Asp  
240 245 250 255

Phe Asp Leu Ser Ala Phe Asn Ala Gly Glu His Thr Lys Ala Cys Glu  
260 265 270

Ala Gln Ala Asn Ala Glu Lys Ile Cys Tyr Ile Leu Tyr Pro Gly Asp  
275 280 285

Glu Ser Glu Glu Gly Lys Ile Leu Arg Leu Lys Gln Gln Tyr Thr Leu  
290 295 300

Cys Ser Ala Ser Leu Gln Asp Ile Ile Ser Arg Phe Glu Arg Arg Ser  
305 310 315

Gly Asp Arg Ile Lys Trp Glu Glu Phe Pro Glu Lys Val Ala Val Gln  
320 325 330 335

Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu Leu Met Arg Ile  
340 345 350

Leu Ile Asp Leu Lys Gly Leu Asn Trp Asn Glu Ala Trp Asn Ile Thr  
355 360 365

Gln Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala Leu  
370 375 380

Glu Lys Trp Ser Tyr Glu Leu Met Gln Lys Leu Leu Pro Arg His Val  
385 390 395

Glu Ile Ile Glu Ala Ile Asp Glu Glu Leu Val His Glu Ile Val Leu  
400 405 410 415

Lys Tyr Gly Ser Met Asp Leu Asn Lys Leu Glu Glu Lys Leu Thr Thr  
420 425 430

Met Arg Ile Leu Glu Asn Phe Asp Leu Pro Ser Pro Val Ala Glu Leu  
435 440 445

Phe Ile Lys Pro Glu Ile Ser Val Asp Asp Asp Thr Glu Thr Val Glu  
450 455 460

Val His Asp Lys Val Glu Ala Ser Asp Lys Val Val Thr Asn Asp Glu  
465 470 475

Asp Asp Thr Gly Lys Lys Thr Ser Val Lys Ile Glu Ala Ala Ala Glu  
480 485 490 495

Lys Asp Ile Asp Lys Lys Thr Pro Val Ser Pro Glu Pro Ala Val Ile  
500 505 510

Pro Pro Lys Lys Val Arg Met Ala Asn Leu Cys Val Val Gly Gly His  
515 520 525

Ala Val Asn Gly Val Ala Glu Ile His Ser Glu Ile Val Lys Glu Glu  
530 535 540

Val Phe Asn Asp Phe Tyr Glu Leu Trp Pro Glu Lys Phe Gln Asn Lys  
545 550 555

Thr Asn Gly Val Thr Pro Arg Arg Trp Ile Arg Phe Cys Asn Pro Pro  
560 565 570 575

Leu Ser Ala Ile Ile Thr Lys Trp Thr Gly Thr Glu Asp Trp Val Leu  
580 585 590

Lys Thr Glu Lys Leu Ala Glu Leu Gln Lys Phe Ala Asp Asn Glu Asp  
595 600 605

Leu Gln Asn Glu Trp Arg Glu Ala Lys Arg Ser Asn Lys Ile Lys Val  
610 615 620

Val Ser Phe Leu Lys Glu Lys Thr Gly Tyr Ser Val Val Pro Asp Ala  
625 630 635

Met Phe Asp Ile Gln Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu  
640 645 650 655

Leu Asn Ile Phe Gly Ile Val Tyr Arg Tyr Lys Lys Met Lys Glu Met  
660 665 670

Thr Ala Ala Glu Arg Lys Thr Asn Phe Val Pro Arg Val Cys Ile Phe  
675 680 685

Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln Ala Lys Arg Ile Val Lys  
690 695 700

Phe Ile Ile Asp Val Gly Ala Thr Ile Asn His Asp Pro Glu Ile Gly  
705 710 715

Asp Leu Leu Lys Val Val Phe Val Pro Asp Tyr Asn Val Ser Val Ala  
720 725 730 735

Glu Leu Leu Ile Pro Ala Ser Asp Leu Ser Glu His Ile Ser Thr Ala  
740 745 750

Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Met Asn Gly  
755 760 765

Cys Ile Gln Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu  
770 775 780

Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Gln Ala His Glu  
785 790 795

Ile Ala Gly Leu Arg Lys Glu Arg Ala Asp Gly Lys Phe Val Pro Asp  
800 805 810 815

Glu Arg Phe Glu Glu Val Lys Glu Phe Val Arg Ser Gly Ala Phe Gly  
820 825 830

Ser Tyr Asn Tyr Asp Asp Leu Ile Gly Ser Leu Glu Gly Asn Glu Gly  
835 840 845

Phe Gly Arg Ala Asp Tyr Phe Leu Val Gly Lys Asp Phe Pro Ser Tyr  
850 855 860

Ile Glu Cys Gln Glu Lys Val Asp Glu Ala Tyr Arg Asp Gln Lys Arg  
865 870 875

Trp Thr Thr Met Ser Ile Leu Asn Thr Ala Gly Ser Tyr Lys Phe Ser  
880 885 890 895

Ser Asp Arg Thr Ile His Glu Tyr Ala Lys Asp Ile Trp Asn Ile Glu  
900 905 910

Ala Val Glu Ile Ala  
915

<210> 35  
<211> 797  
<212> PRT  
<213> Escherichia coli

<400> 35

Met Ser Gln Pro Ile Phe Asn Asp Lys Gln Phe Gln Glu Ala Leu Ser  
1 5 10 15

Arg Gln Trp Gln Arg Tyr Gly Leu Asn Ser Ala Ala Glu Met Thr Pro  
20 25 30

Arg Gln Trp Trp Leu Ala Val Ser Glu Ala Leu Ala Glu Met Leu Arg  
35 40 45

Ala Gln Pro Phe Ala Lys Pro Val Ala Asn Gln Arg His Val Asn Tyr  
50 55 60

Ile Ser Met Glu Phe Leu Ile Gly Arg Leu Thr Gly Asn Asn Leu Leu

65	70	75	80
Asn Leu Gly Trp Tyr Gln Asp Val Gln Asp Ser Leu Lys Ala Tyr Asp			
	85	90	95
Ile Asn Leu Thr Asp Leu Leu Glu Glu Glu Ile Asp Pro Ala Leu Gly			
	100	105	110
Asn Gly Gly Leu Gly Arg Leu Ala Ala Cys Phe Leu Asp Ser Met Ala			
	115	120	125
Thr Val Gly Gln Ser Ala Thr Gly Tyr Gly Leu Asn Tyr Gln Tyr Gly			
	130	135	140
Leu Phe Arg Gln Ser Phe Val Asp Gly Lys Gln Val Glu Ala Pro Asp			
145	150	155	160
Asp Trp His Arg Ser Asn Tyr Pro Trp Phe Arg His Asn Glu Ala Leu			
	165	170	175
Asp Val Gln Val Gly Ile Gly Gly Lys Val Thr Lys Asp Gly Arg Trp			
	180	185	190
Glu Pro Glu Phe Thr Ile Thr Gly Gln Ala Trp Asp Leu Pro Val Val			
	195	200	205
Gly Tyr Arg Asn Gly Val Ala Gln Pro Leu Arg Leu Trp Gln Ala Thr			
210	215	220	
His Ala His Pro Phe Asp Leu Thr Lys Phe Asn Asp Gly Asp Phe Leu			
225	230	235	240
Arg Ala Glu Gln Gln Gly Ile Asn Ala Glu Lys Leu Thr Lys Val Leu			
	245	250	255
Tyr Pro Asn Asp Asn His Thr Ala Gly Lys Lys Leu Arg Leu Met Gln			
	260	265	270
Gln Tyr Phe Gln Cys Ala Cys Ser Val Ala Asp Ile Leu Arg Arg His			
	275	280	285
His Leu Ala Gly Arg Glu Leu His Glu Leu Ala Asp Tyr Glu Val Ile			
290	295	300	
Gln Leu Asn Asp Thr His Pro Thr Ile Ala Ile Pro Glu Leu Leu Arg			

305

310

315

320

Val Leu Ile Asp Glu His Gln Met Ser Trp Asp Asp Ala Trp Ala Ile  
325 330 335

Thr Ser Lys Thr Phe Ala Tyr Thr Asn His Thr Leu Met Pro Glu Ala  
340 345 350

Leu Glu Arg Trp Asp Val Lys Leu Val Lys Gly Leu Leu Pro Arg His  
355 360 365

Met Gln Ile Ile Asn Glu Ile Asn Thr Arg Phe Lys Thr Leu Val Glu  
370 375 380

Lys Thr Trp Pro Gly Asp Glu Lys Val Trp Ala Lys Leu Ala Val Val  
385 390 395 400

His Asp Lys Gln Val His Met Ala Asn Leu Cys Val Val Gly Gly Phe  
405 410 415

Ala Val Asn Gly Val Ala Ala Leu His Ser Asp Leu Val Val Lys Asp  
420 425 430

Leu Phe Pro Glu Tyr His Gln Leu Trp Pro Asn Lys Phe His Asn Val  
435 440 445

Thr Asn Gly Ile Thr Pro Arg Arg Trp Ile Lys Gln Cys Asn Pro Ala  
450 455 460

Leu Ala Ala Leu Leu Asp Lys Ser Leu Gln Lys Glu Trp Ala Asn Asp  
465 470 475 480

Leu Asp Gln Leu Ile Asn Leu Val Lys Leu Ala Asp Asp Ala Lys Phe  
485 490 495

Arg Asp Leu Tyr Arg Val Ile Lys Gln Ala Asn Lys Val Arg Leu Ala  
500 505 510

Glu Phe Val Lys Val Arg Thr Gly Ile Asp Ile Asn Pro Gln Ala Ile  
515 520 525

Phe Asp Ile Gln Ile Lys Arg Leu His Glu Tyr Lys Arg Gln His Leu  
530 535 540

Asn Leu Leu His Ile Leu Ala Leu Tyr Lys Glu Ile Arg Glu Asn Pro

545	550	555	560
Gln Ala Asp Arg Val Pro Arg Val Phe Leu Phe Gly Ala Lys Ala Ala			
	565	570	575
Pro Gly Tyr Tyr Leu Ala Lys Asn Ile Ile Phe Ala Ile Asn Lys Val			
	580	585	590
Ala Asp Val Ile Asn Asn Asp Pro Leu Val Gly Asp Lys Leu Lys Val			
	595	600	605
Val Phe Leu Pro Asp Tyr Cys Val Ser Ala Ala Glu Lys Leu Ile Pro			
	610	615	620
Ala Ala Asp Ile Ser Glu Gln Ile Ser Thr Ala Gly Lys Glu Ala Ser			
	625	630	635
			640
Gly Thr Gly Asn Met Lys Leu Ala Leu Asn Gly Ala Leu Thr Val Gly			
	645	650	655
Thr Leu Asp Gly Ala Asn Val Glu Ile Ala Glu Lys Val Gly Glu Glu			
	660	665	670
Asn Ile Phe Ile Phe Gly His Thr Val Lys Gln Val Lys Ala Ile Leu			
	675	680	685
Ala Lys Gly Tyr Asp Pro Val Lys Trp Arg Lys Lys Asp Lys Val Leu			
	690	695	700
Asp Ala Val Leu Lys Glu Leu Glu Ser Gly Lys Tyr Ser Asp Gly Asp			
	705	710	715
			720
Lys His Ala Phe Asp Gln Met Leu His Ser Ile Gly Lys Gln Gly Gly			
	725	730	735
Asp Pro Tyr Leu Val Met Ala Asp Phe Ala Ala Tyr Val Glu Ala Gln			
	740	745	750
Lys Gln Val Asp Val Leu Tyr Arg Asp Gln Glu Ala Trp Thr Arg Ala			
	755	760	765
Ala Ile Leu Asn Thr Ala Arg Cys Gly Met Phe Ser Ser Asp Arg Ser			
	770	775	780
Ile Arg Asp Tyr Gln Ala Arg Ile Trp Gln Ala Lys Arg			

785                      790                      795

<210> 36  
<211> 37  
<212> DNA  
<213> Artificial sequence

<220>  
<223> sequence of connection portion of plasmid and gene

<400> 36  
accctaatcg ataggaggaa aacatatgac cttgagt 37

<210> 37  
<211> 38  
<212> DNA  
<213> Artificial sequence

<220>  
<223> sequence of connection portion of plasmid and gene

<400> 37  
gcataagagg gggaagtgaa tgaaaaggta ccttcggg 38

<210> 38  
<211> 41  
<212> DNA  
<213> Artificial sequence

<220>  
<223> primer sequence

<400> 38  
aatcgatag gaggaacaaca tatgacctg agtgagaaa t 41

<210> 39  
<211> 29  
<212> DNA  
<213> Artificial sequence

<220>  
<223> primer sequence

<400> 39  
gaaggtacct ttccattcac ttccccctc 29

<210> 40  
<211> 32  
<212> DNA  
<213> Artificial sequence

<220>  
<223> primer sequence

<400> 40



ttcggatcct caccttgagt gagaaaattc ac

32

<210> 41  
<211> 29  
<212> DNA  
<213> Artificial sequence

<220>  
<223> primer sequence

<400> 41  
ttcggatcct ttccattcac ttccccctc

29

<210> 42  
<211> 71  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> primer sequence

<400> 42  
aaatcgatag gaggaaaaca tatggcaaac gccaatggaa aagctgac tagttaccg 60

gagaaaatct c 71

<210> 43  
<211> 59  
<212> DNA  
<213> Artificial sequence

<220>  
<223> primer sequence

<400> 43  
gaaggtacct tagggaacag gacaagcctc aatgttccaa atctcttgg catactgag 59

<210> 44  
<211> 9  
<212> PRT  
<213> Solanum tuberosum

<400> 44

His Ala Glu Phe Thr Pro Val Phe Ser  
1 5

<210> 45  
<211> 9  
<212> PRT  
<213> Oryza sativa

<400> 45

His Ala Gln Tyr Ser Pro His Phe Ser

1 5

<210> 46  
<211> 8  
<212> PRT  
<213> Solanum tuberosum

<400> 46

Ala Leu Gly Asn Gly Gly Leu Gly  
1 5

<210> 47  
<211> 9  
<212> PRT  
<213> Solanum tuberosum

<400> 47

Arg Ile Val Lys Phe Ile Thr Asp Val  
1 5

<210> 48  
<211> 9  
<212> PRT  
<213> Oryza sativa

<400> 48

Arg Ile Val Lys Leu Val Asn Asp Val  
1 5